ONE AND TWO WORLD TRADE CENTER
Structural Integrity Inspection

Accessible Columns

LERA Job. 1133902
PA Job. W2 702.302

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LERA

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Accessible Columns

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1. EXECUTIVE SUMMARY

Leslie E. Robertson Associates, R.L.L.P. (LERA) conducted a survey of accessible columns in the elevator shafts of One and Two World Trade Center as part of ongoing structural integrity inspections.

The purpose of this inspection is to assess the overall structural integrity of the accessible columns. We have provided a full description, recommendation and photograph for each type of finding in Section 6. The following is a list of the findings.

Section 6.1 Columns
- Item 1 Deterioration of fireproofing
- Item 2 Exposed steel at guide rail angles
- Item 3 Exposed steel at damaged drywall enclosure
- Item 4 Exposed web of column
- Item 5 Apparent water damage
- Item 6 Damage to fireproofing due to compensation cable
- Item 7 Exposed erection bolt at column
- Item 8 Damage and cracking of fireproofing

Section 6.2 Pits
- Item 9 Exposed steel at column base
- Item 10 Exposed steel at column base and exposure continuing to floor below

Section 6.3 Slab in Pits
- Item 11 Rough surface condition at top of slab

Section 6.4 Connecting Beams
- Item 12 Exposed steel at webs and flanges of connecting beams
- Item 13 Deterioration of erection bolts ends on connecting beams
- Item 14 Web of beams warped
- Item 15 Fire protection appears compromised

For the accessible columns in the elevator shafts of One and Two World Trade Center, we observed no sign of structural deficiencies such as cracking, bowing or deviation from plumb. The columns also showed no visible signs of lateral displacements. Signs of light rust were typical on most exposed steel encountered. Moderate rust on columns was prevalent within the elevator pits.

Based on our observations and our evaluations of the inspection, we believe that the structural integrity is good for the accessible columns within the selected elevator shafts.

2. INTRODUCTION

As part of the PANYNJ structural inspection program, we carried out a survey of the accessible columns in the elevator shafts of One and Two World Trade Center. Access to the selected elevator shafts was provided by Mr. Robert Lynch of P.A. and Mr. Tom Davies of A.C.E. Elevators Co.

This report is the third in a continuing program to assess the condition of accessible columns in the One and Two World Trade Center. For past reports refer to the following World Trade Center Structural Integrity Inspection reports:

- Towers 1 & 2 Accessible Columns, 14 April 1995; and
- Accessible Columns at 1, 2, 4 and 5 WTC, 29 January 1993.

Accessible columns are those columns not enclosed by an architectural finish and can be visually inspected. From the original architectural drawings, we selected accessible columns situated within elevator shafts for inspection. Selected shafts are chosen on the basis of the quantity and types of inspectable columns within the shaft and convenience to the PANYNJ.

The purpose of this inspection is to assess the overall structural integrity of the accessible columns. We visually inspected the columns for the following:

- signs of rust, cracking, bowing, or deviation from plumb;
- specific locations of structural distress or damage; and
- lateral displacement or rotation of the column about a vertical axis where the column is braced directly on only one axis by connecting beams or abutting concrete slabs due to large beam offset dimensions.

In addition, we noted the following:

- locations of damage to the fireproofing envelopes; and
- signs of rust, or deformation of the slabs on ground surrounding each column.

Recommendations for remedial action are provided for both structural and fireproofing damage.

Our information is from visual observations made during February 1996, of selected columns within elevator shafts. We carried out the visual assessment of the accessible columns in the elevator shafts from the top of the elevator cars. A total of 38 elevator shafts and 51 elevator pits were selected, this selection included 28 local elevators and 10 express elevators.

3. INSPECTION METHODOLOGY

We visually inspected the accessible columns located in the core from the top of elevator cars and from walk-throughs of the elevator pits. The elevator car was operated by two people from A.C.E. Elevator Co.

The accessible columns are not directly visible due to their fireproofing; therefore, the visual observations depended on the condition of the fireproofing. The steel columns within the shafts are typically encased by one of the following methods of fire protection:

Spray - on fireproofing (sometimes containing asbestos);
Spray - on coated with cementitious fireproofing; and
Cementitious fireproofing.

We removed loose, cracked or rust stained material to allow us to examine the steel. However, in several instances, the structural columns and the connecting beams were visible for inspection purposes due to missing fireproofing.

The inspected columns within the elevator shaft are identified as to general location (building number, floor or floors), description label (column number, elevator number) and the type and location of the affected part. Further, photographs are taken to clarify some locations and conditions of the defective areas. We did not make inspection notes and photographs when defects were not found. We observed each accessible column within the elevator shaft for the items noted in the introduction.

4. LIST OF INSPECTED COLUMNS - 1 WTC

Elevator Shaft/Pit	Column Number	Pit/Floors Inspected	Face Of Column Inspected
6A	904	B4/2-106	West & South
7A	903	B4/2-106	East
16A	603	B4/2-78	East
17A	604	B4/2-78	West & South
34A	706	B1/2-24	East & North
35A	805	2-24	East & North
42A	802	2-40	East & North
43A	702	B1/2-40	East & North
55A	707	43	East, North & South
56A	806	43	East, North & South
61A	706	43/44-61	East & North
62A	805	43/44-61	East & North
63A	801	43	East, North & South
64A	701	43	East, North & South
67A	702	42	West, North & South
68A	802	43	West, North & South
69A	802	43/44-74	East & North
70A	702	43/44-74	East & North
78A	707	76	East, North & South
79A	806	76	East, North & South

4. LIST OF INSPECTED COLUMNS - 1 WTC (continued)

Elevator Shaft/Pit	Column Number	Pit/Floors Inspected	Face Of Column Inspected
82A	801	77	East, North & South
83A	701	77	East, North & South
88A	802	77/78-100	East & North
89A	702	77/78-100	East, North & South
94A	805	77/78-107	East & North
95A	706	77/78-107	East, North & South
96A	707	77/78-106	West & South
97A	806	77/78-106	West, North & South
99A	703/803	105/106-110	West

Previously Inspected

Elevator Shaft/Pit	Column Number	Pjt/Floors Inspected	Face Of Column Inspected
1A	908	B2/2-44	West & South
2A	907	B2/2-44	East
3A	907	B2/2-44	West & South
4A	906	B2/2-44	East
8A	903	B2/2-44	West & South
9A	902	B2/2-44	East
12A	601	B2/2-78	East & North
13A	602	B2/2-78	West & North

4. LIST OF INSPECTED COLUMNS - 1 WTC (continued)

Previously Inspected

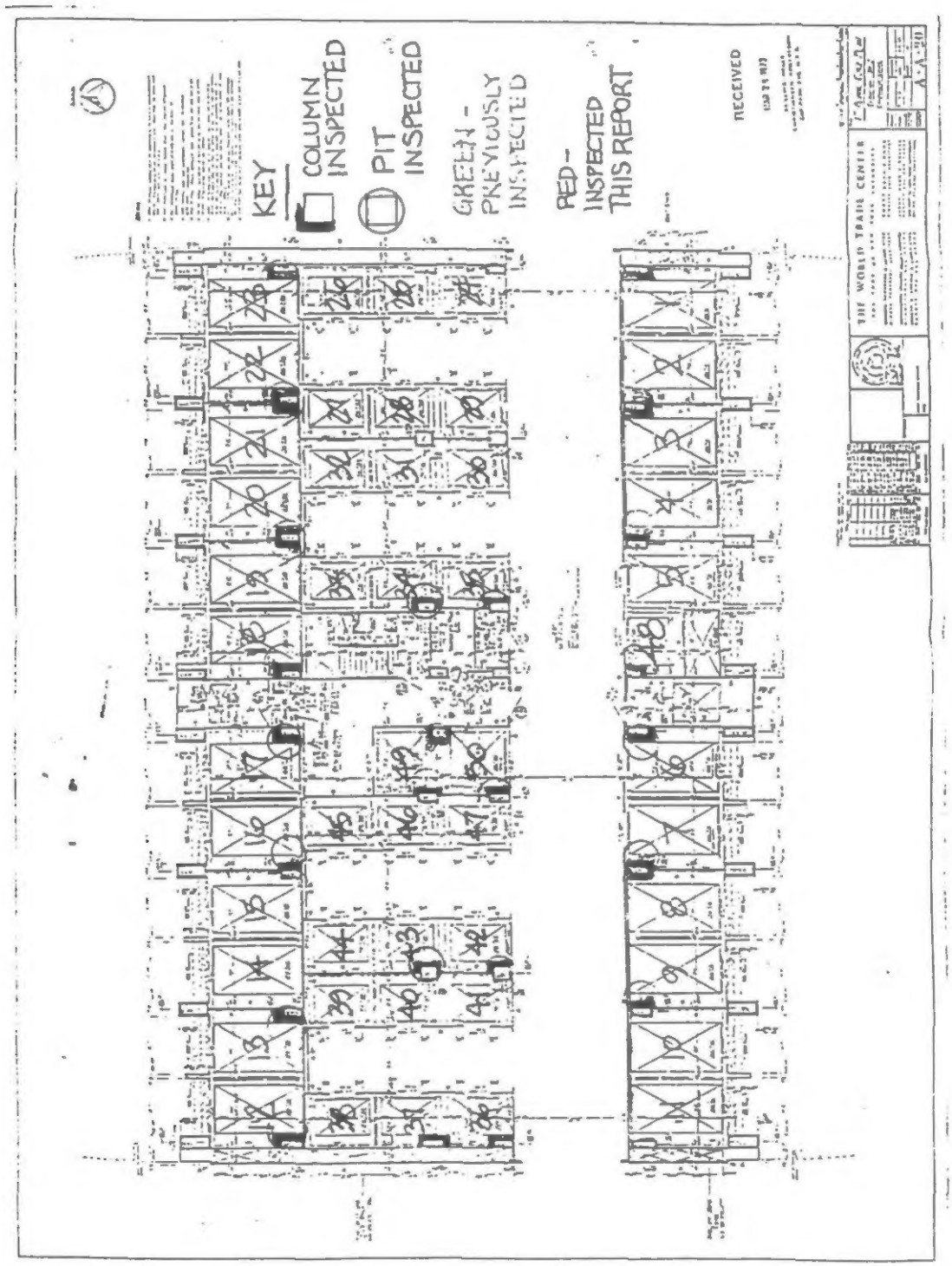
Elevator Shaft/Pit	Column Number	Pit/Floors Inspected	Face Of Column Inspected
14A	602	B2	East
15A	603	B2	West & North
18A	605	B2/2-78	East & North
19A	606	B2/2-78	West
20A	606	B2/4-78	East & North
21A	607	B2/4-78	East & West
22A	607	B2/2-78	East & North
23A	608	B2/2-78	West & North
24A	807	B3	West & North
29A	806	B3	East & North
30A	806	B3	West & North
35A	805	B3	East & North
36A	801	B3/1-32	East & North
37A	701	1-32	East & South
41A	802	B3	West & North
42A	802	B3	East & North
47A	803	B3	West & North

4. LIST OF INSPECTED COLUMNS - 1 WTC (continued)

Previously Inspected

Elevator Shaft/Pit	Column Number	Pit/Floors Inspected	Face Of Column Inspected
48A	905	B3	East & South
49A	704	B3	North
50A	704 703 803	2-108 2-78 2-108	West & South East East
63A	701	45-67	East & South
64A	801	45-67	East & South
73A	703	43-74	North & West
74A	803	43-74	North & West
82A	801	78-93	East & South
83A	701	78-93	East & North

1 WTC


KEY
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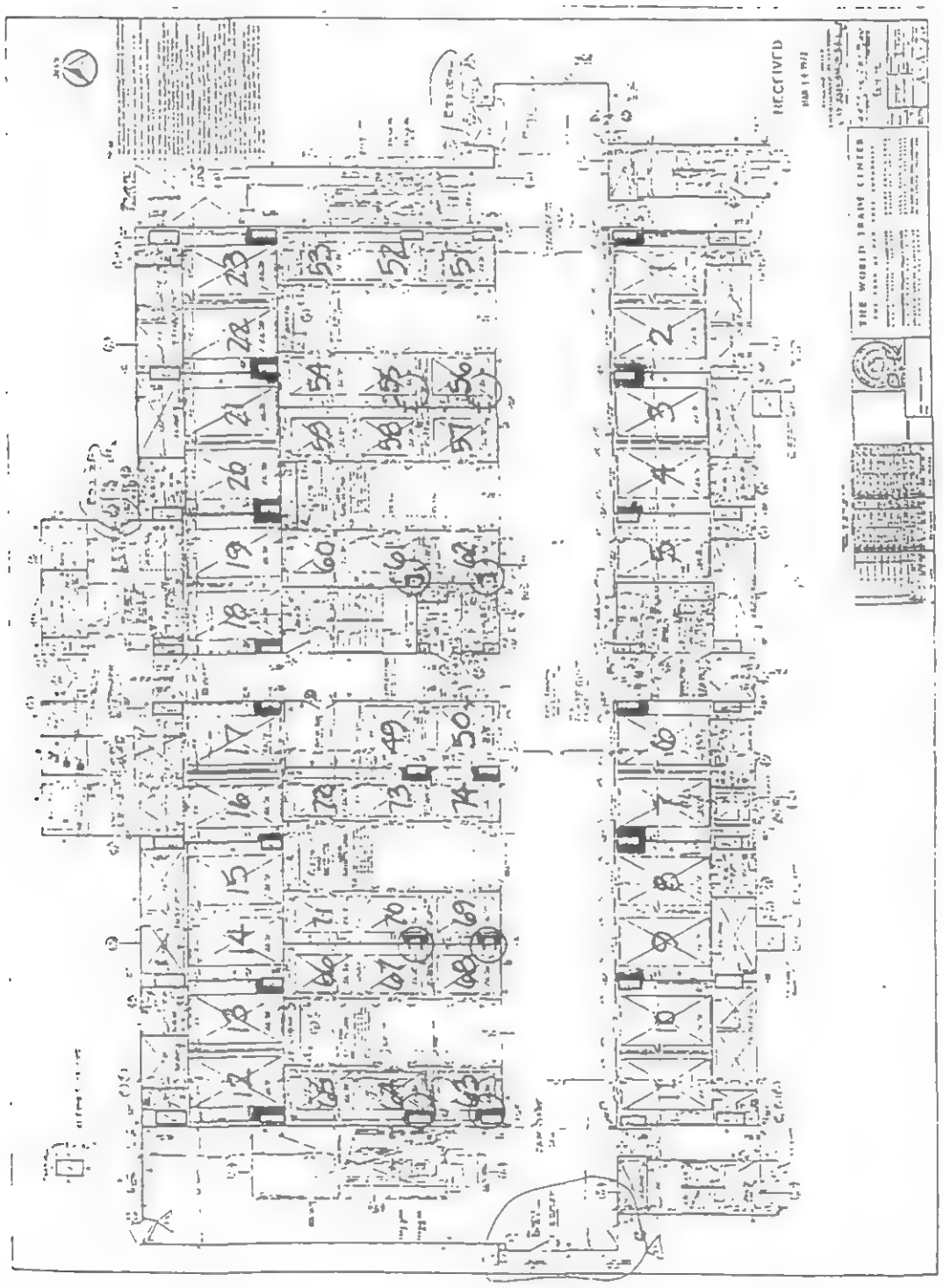
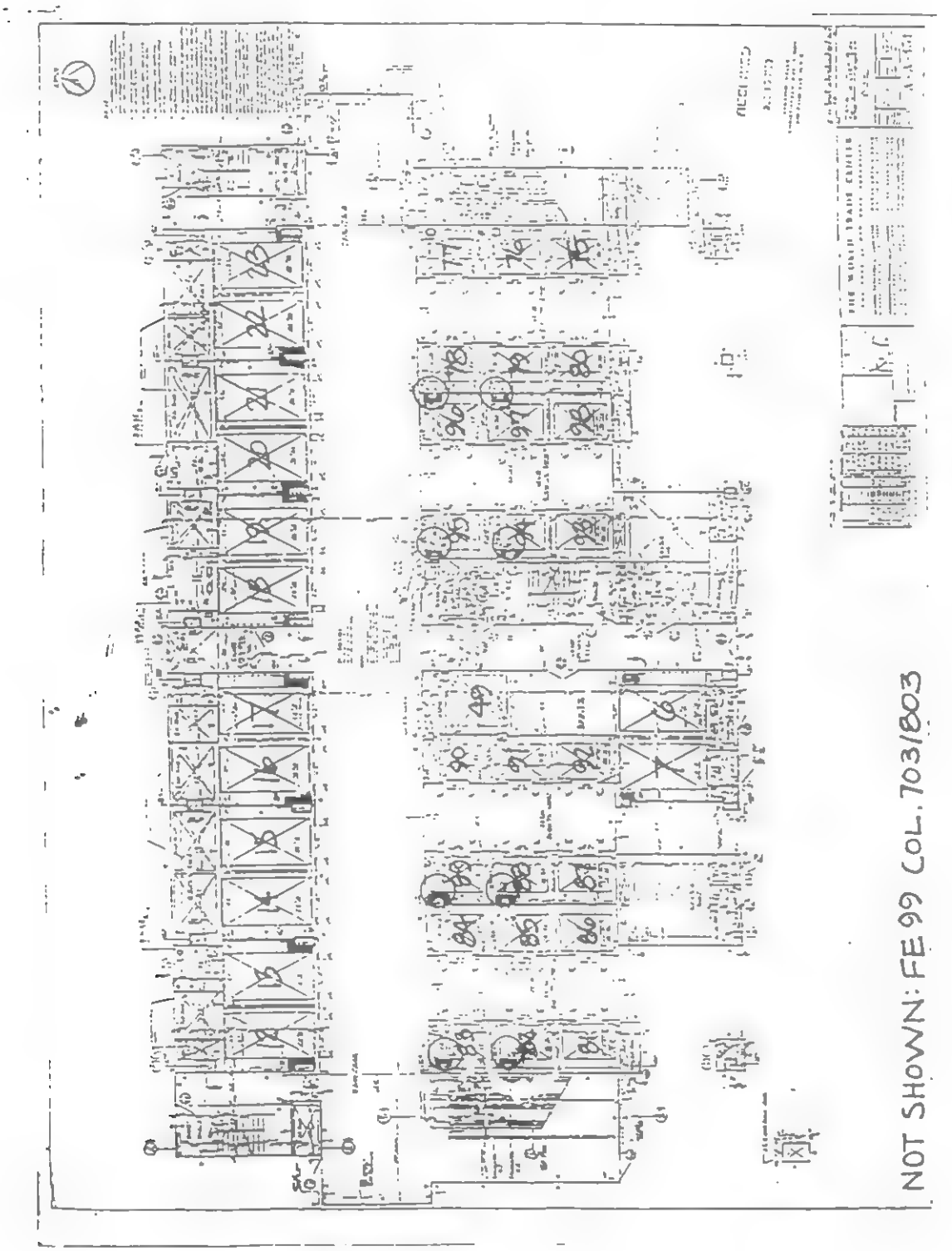
PIT INSPECTED
GREEN - PREVIOUSLY INSPECTED
RED - INSPECTED THIS REPORT
RECEIVED

1 WTC



1 WTC



5. LIST OF INSPECTED COLUMNS - 2 WTC

Elevator Shaft/Pit	Column Number	Pit/Floors Inspected	Face Of Column Inspected
6B	904	2-106	East & South
7B	903	2-106	North
18B	605	2-78	West & North
19B	606	2-78	South
20B	606	2-78	West & North
21B	607	2-78	South
34B	706	B1/2-23	West & North
35B	805	B3/2-23	West & North
42B	802	2-40	West & North
43B	702	B1/2-40	West & North
48B	905	B3	East & North
55B	707	43	East, West & North
56B	806	43	East, West & North
61B	706	43/44-61	West & North
62B	805	43/44-61	West & North
63B	801	43	East, West & North
64B	701	43	East, West & North
67B	702	42	East, West & South
68B	802	43	East, West & South
69B	802	43/44-74	West & North

5. LIST OF INSPECTED COLUMNS - 2 WTC (continued)

Elevator Shaft/Pit	Column Number	Pit/Floors Inspected	Face Of Column Inspected
70B	702	43/44-74	West & North
78B	707	76	East, West & North
79B	806	76	East, West & North
82B	801	77	East, West & North
83B	701	77	East, West & North
88B	802	77/78-100	East, West & North
89B	702	77/78-100	East, West & North
95B	706	77	West & North
96B	707	77/78-106	East, West & South
97B	806	77/78-106	West & South
99B	703/803	105/106-110	South

Previously Inspected

Elevator Shaft/Pit	Column Number	Pits/Floors Inspected	Face Of Column Inspected
1B	908	B2/2-44	East & South
2B	907	B2/2-44	North
3B	907	B2	East & South
4B	906	B2	North
5B	906	B2	East & South
6B	904	B2	East & South

5. LIST OF INSPECTED COLUMNS - 2 WTC (continued)

Previously Inspected

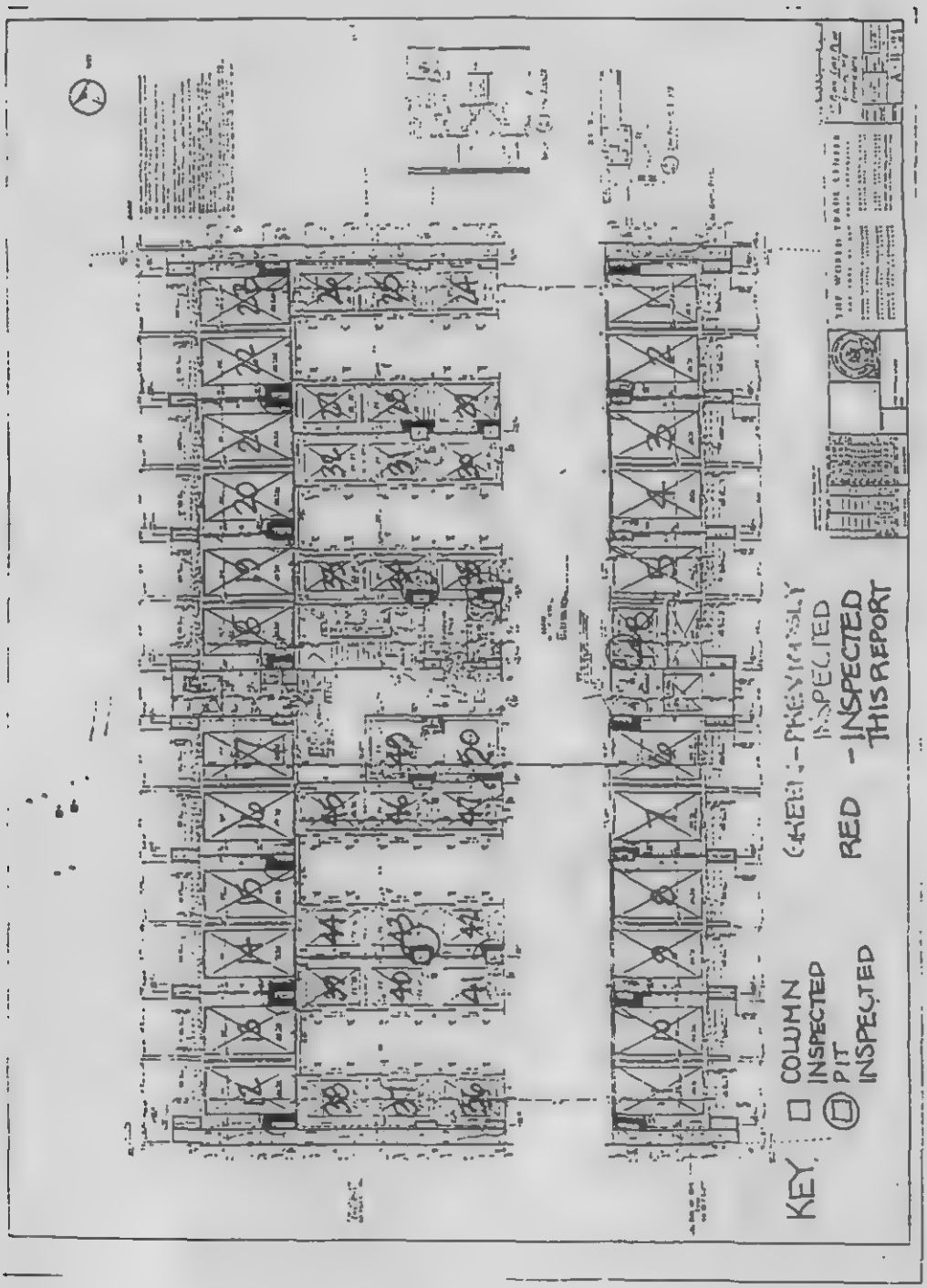
Elevator Shaft/Pit	Column Number	Pits/Floors Inspected	Face Of Column Inspected
7B	903	B2	North
8B	903	B2	East & South
9B	902	B2	North
10B	908	B2/2-44	East & South
11B	901	B2/2-44	East & North
12B	601	B2/2-44	West & North
13B	602	B2/2-78	West & South
14B	602	B2/2-78	North
15B	603	B2/2-78	West & South
16B	603	B4	North
17B	604	B4	West & South
18B	605	B2	West & North
19B	606	B2	South
20B	606	B2	West & North
21B	607	B2	South
22B	607	B2/2-78	West & North
23B	608	B22-78	West & South
28B	707	1-16	East & South
29B	806	1-16	West & South

5. LIST OF PREVIOUSLY INSPECTED - 2 WTC (continued)

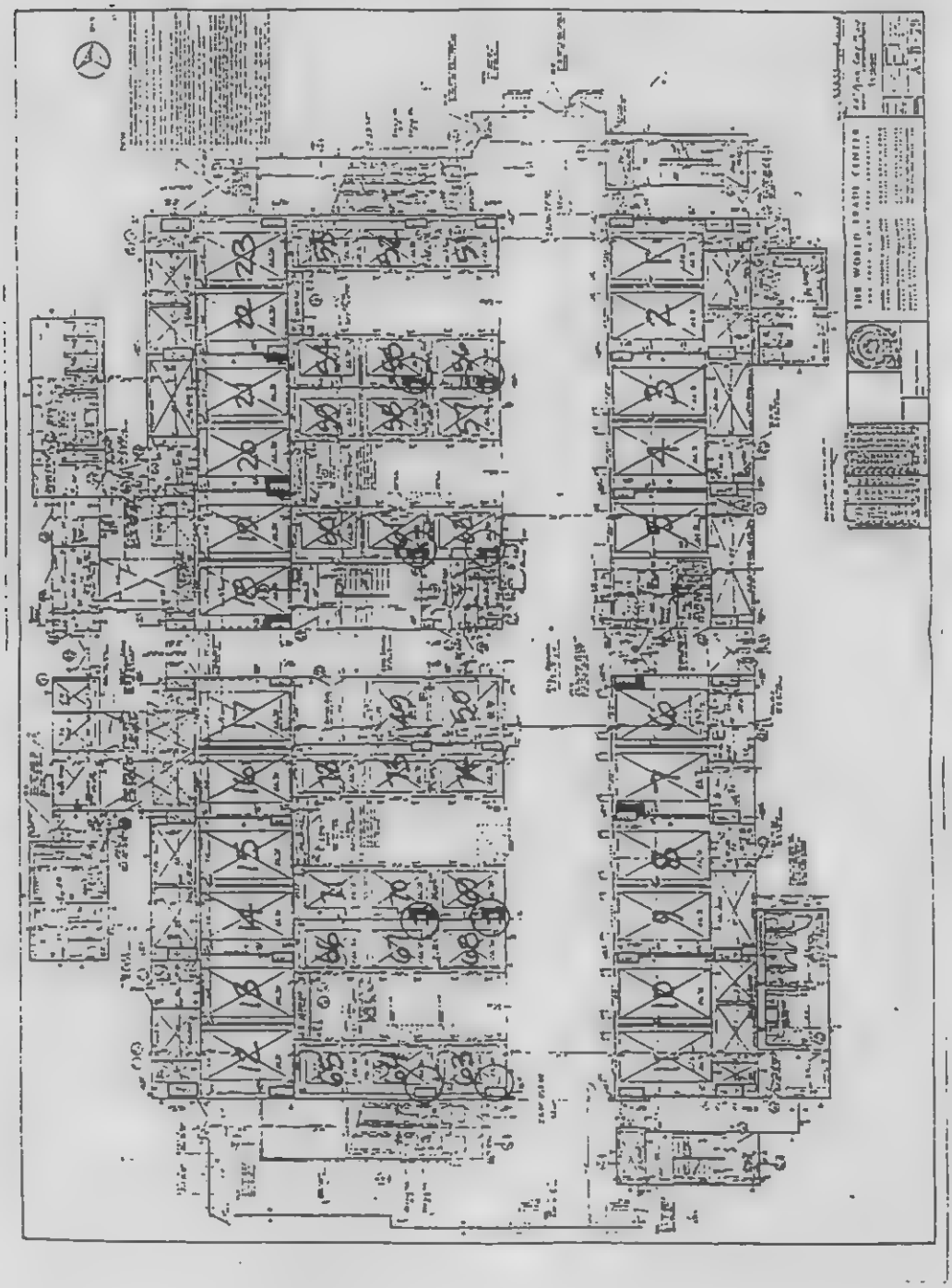
Previously Inspected

Elevator Shaft/Pit	Column Number	Pit/Floors Inspected	Face Of Column Inspected
36B	801	B3	West & North
41B	802	B3	West & South
42B	802	B3	West & North
47B	803	B3	West & South
49B	704	B6	West & South
50B	704 703 803	2-108 2-78 2-108	East & South North North
55B	707	45-54	East & South
56B	806	45-54	East & West
78B	707	78-86	East & South
79B	806	78-86	East & West

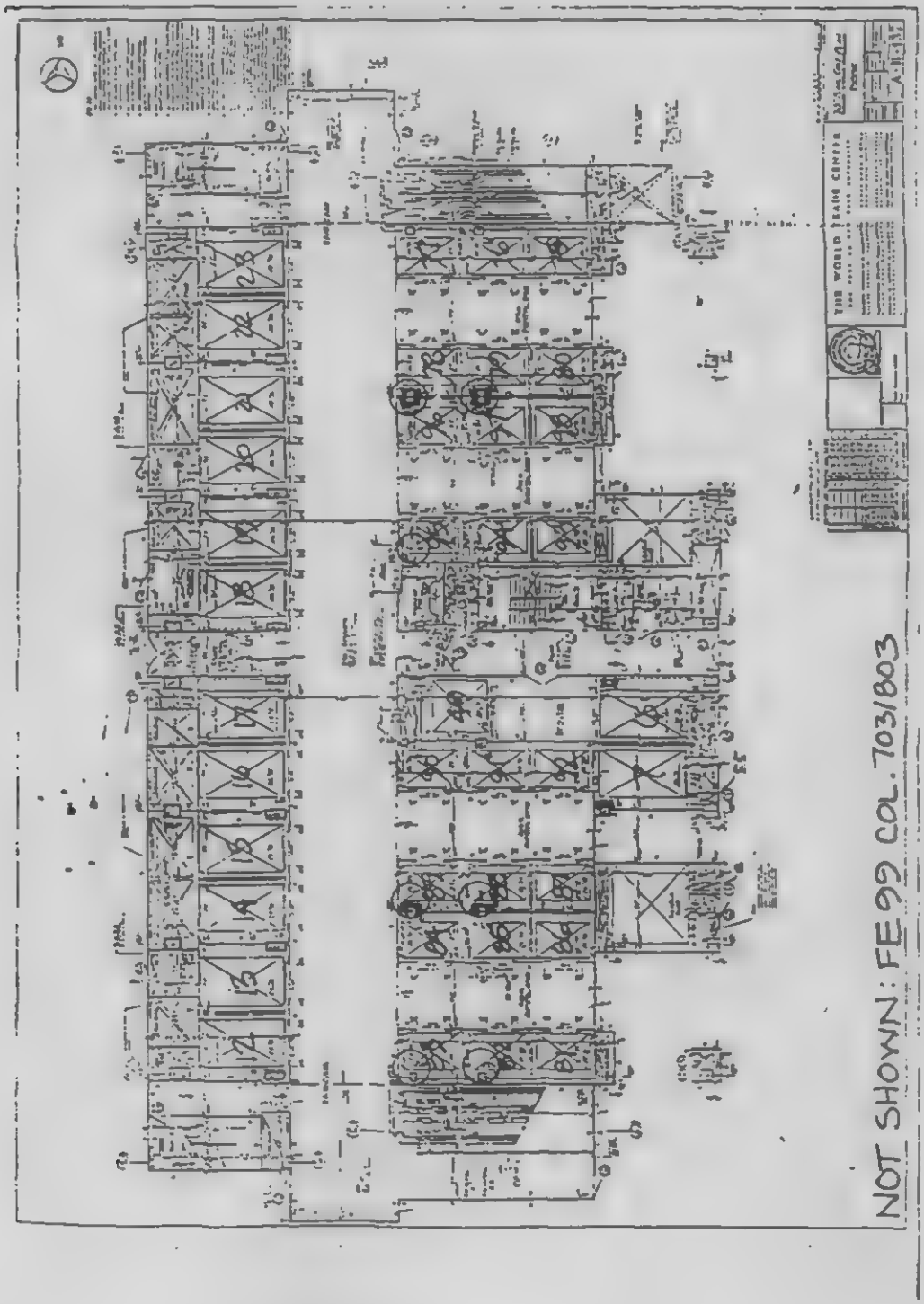
2WTC


KEY
COLUMN INSPECTED
PIT INSPECTED
RED - INSPECTED THIS REPORT

2WTC



2WTC



6. FINDINGS, RECOMMENDATIONS AND PHOTOGRAPHS

For the accessible columns in the elevator shafts of One and Two World Trade Center, we observed no sign of structural deficiencies such as cracking, bowing or deviation from plumb. The columns also showed no visible signs of lateral displacements. Signs of light rust were typical on most exposed steel encountered. Moderate rust on columns was prevalent within the elevator pits.

The most common condition in both the express and the local elevator shafts and pits were areas of missing fireproofing which allowed us to examine the steel. Missing fireproofing on columns and beams appear to be a result of general deterioration, deterioration due to the rubbing of elevator cables, testing purposes, or air pressure produced by the movement of the elevators within the shaft.

Missing fireproofing on columns ranged from small areas of an inch in diameter to full floor height and width of the column. The columns in the pit areas are generally missing fireproofing at their base.

For exposed areas of steel, we recommend the steel be properly cleaned and fire protected. The existing spray fireproofing may contain asbestos, therefore, adequate measures should be undertaken to ascertain the presence of asbestos and to ensure both the protection of personnel and the proper handling of the material.

The spray fireproofing on beams in the shuttle elevators are deteriorating due to the apparent continual rubbing from elevator cables. In some cases where the fireproofing is completely deteriorated, the cables are rubbing against exposed steel, leaving black marks. In most cases, damage to the steel appears limited to the surface.

We recommend PANYNJ eliminate or reduce the cable sway by a cable damping device where feasible to protect both the connecting beams and the cables from continual rubbing.

We observed in elevator shaft 34B, two damaged beams located at the bottom of floor 9 and floor 10. The web and flange of the beams were warped. The source of the damage is unknown. We recommend that testing be done on the two beams.

6. FINDINGS, RECOMMENDATIONS AND PHOTOGRAPHS (continued)

For each recommended repair, the relative urgency of the action to be taken is categorized as "immediate", "priority", or "routine". The definition of each action is as follows.

Immediate. - Action includes possible closure of the area and/or structure affected until interim remedial actions are implemented.

Priority - This action takes precedence over all other scheduled work. This work should not wait for routine repair procedures since waiting may make the damaged area less accessible or allow the damage to quickly worsen to an "immediate" category.

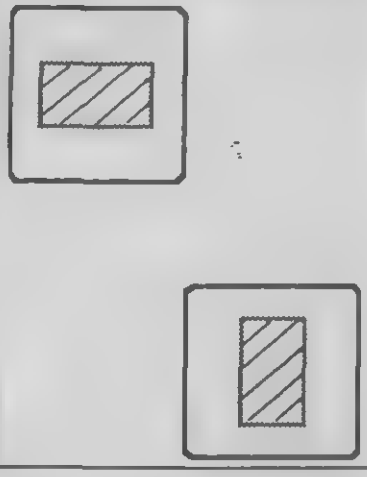
Routine - Further investigation and/or remedial work can be undertaken as a part of a scheduled work program or routine facility maintenance. This action also refers to all non-priority items.

Section 6 is separated by the following elements,

6.1 Columns
6.2 Pits
6.3 Slab in Pits
6.4 Connecting Beams

Section 7 summarizes all items requiring repairs and lists them by urgency.

6.1 COLUMNS

ITEM: 1 (Sheet 1 of 6)	URGENCY: Routine	Location of Finding
LOCATIONS: Columns in elevator shafts in 1 & 2 WTC **FINDING:** Deterioration of fireproofing Exposed steel with light to moderate surface rust **RECOMMENDED ACTION:** Repair fireproofing per Appendix E		

SPECIFIC LOCATIONS AND DESCRIPTION

1WTC

Elev. Shaft	Floor	Column	Description of Finding
6A	77	904	Deterioration of fireproofing at column transition Exposed steel with moderate surface rust
17A	1	604	Exposed steel at column for one floor with light surface rust
34A	15	706	Exposed steel at column with light surface rust.
35A	6 7	805	Full floor height of exposed steel at floor 6 Deterioration of column fireproofing at floor 7 Light surface rust
69A & 70A	Throughout shaft	802/702	Small patches of fireproofing missing from columns
88A	91	802	Exposed steel column with light surface rust Patches of less than 3 sq. in. of area of missing fireproofing
95A	98 - 100	706	Light surface rust Patches of less than 1 sq. in. of area of missing fireproofing

2WTC

Elev. Shaft	Floor	Column	Description of Finding
18B	3	605	Column flange exposed with light surface rust
19B	2	606	Missing fireproofing from column Light surface rust
19B	5 Sim. condition 46.55.73	606	Exposed steel for full width of the column ranging from a few feet to 6 ft. In height Light surface rust

ITEM: 1 (Sheet 2 of 6)

2WTC - (continued)

Elev. Shaft	Floor	Column	Description of Finding
20B	22 Sim. condition 47,57,64	606	Exposed steel on column approx. Full floor height and width Light surface rust
20B	49	606	Deterioration of fireproofing from column
21B	21	607	Exposed steel on column approx. Full floor height and width Light surface rust
34B &35B	Throughout shaft	706/805	Columns missing small patches of fireproofing
34B	23	702	Column web exposed Heavy surface rust
43B	6	702	Small area of exposed steel approx. 3 sq. in. Light surface rust
62B	57	805	Exposed splice Light rust
70B	69, 72	702	Splice exposed Light surface rust
88B	Throughout shaft	802	Small patches of steel exposed less than one square inch of area on beams and columns
96B	101	706	Exposed flange approx. 4" high Light surface rust
96B	Throughout shafts	706	Small diameter of exposed steel with paint marking, appears to be testing area

ITEM: 1 (Sheet 3 of 6)

PHOTOGRAPHS:

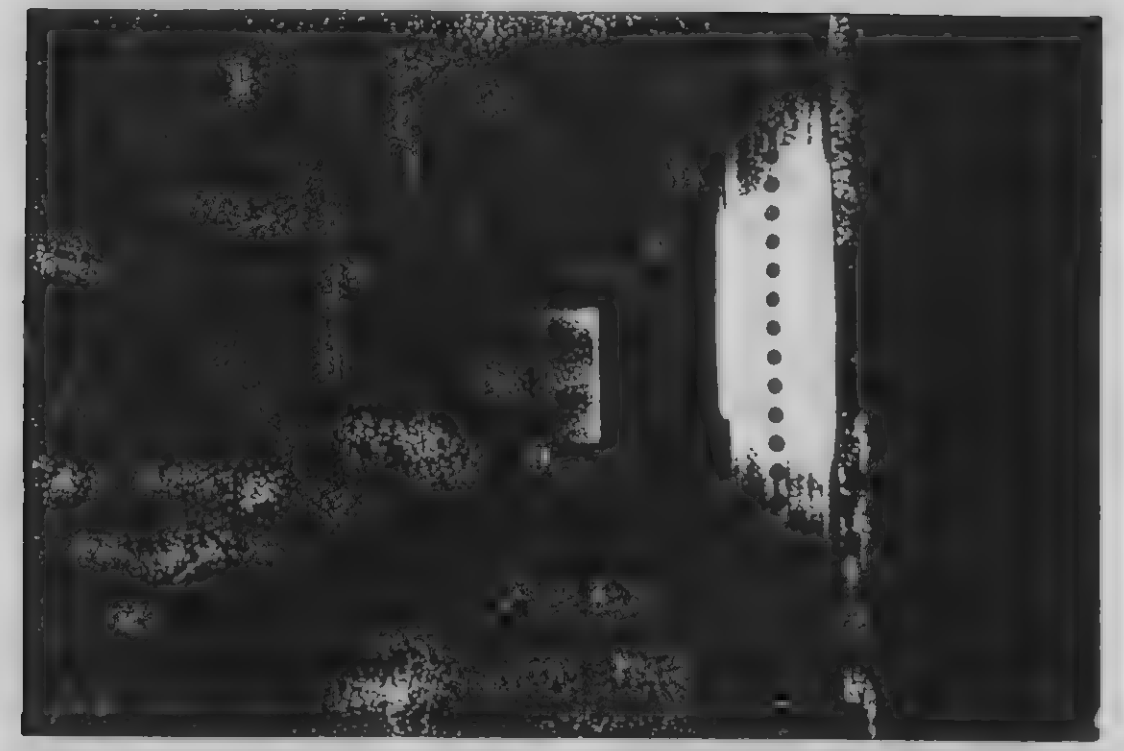


Photo 2	1WTC	Shaft 6A	Floor 49	Col. 904	Exposed steel at unknown plate attachment Light surface rust

ITEM: 1 (Sheet 4 of 6)

Photo 9

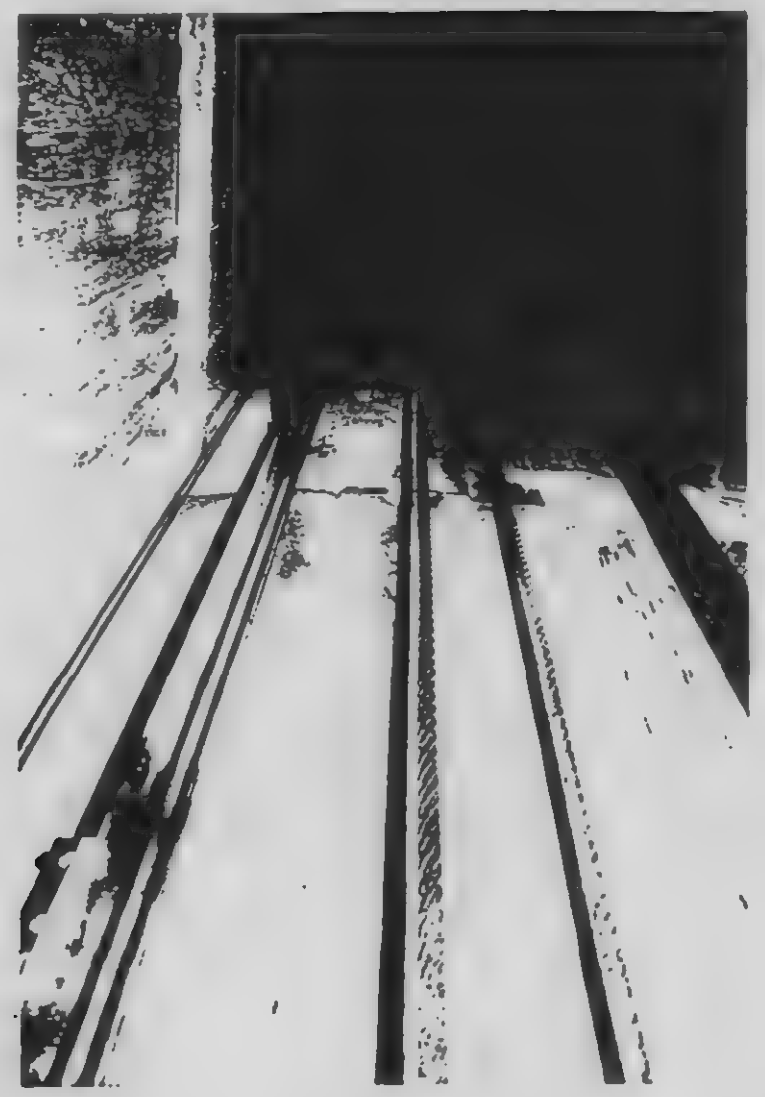
1 WTC

Shaft 16A

Floor 26 looking up Similar condition at floor 27, 28,43, 56

Col. 603

Exposed steel on column and connecting beams
Light rust



ITEM: 1 (Sheet 5 of 6)

Photo 52

2 WTC

Pit 48B

Level B3

Col. 905

Exposed steel at column
- Rusting selector tape appears to deteriorate the fire protection

Debris at pit level

ITEM: 1 (Sheet 6 of 6)

Photo 59

2 WTC

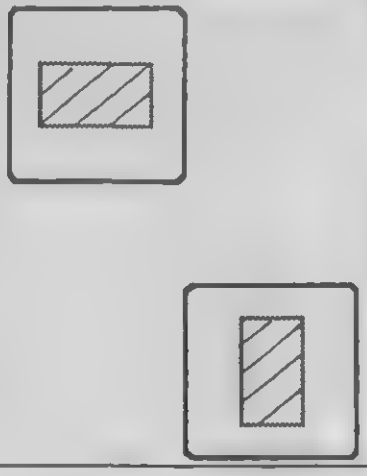
Shaft 70B

Floor 67

Col. 702

Bolts becoming exposed on web of beam
Flange partially exposed on edge and far end of column flange where sheet rock cant is damaged
Deterioration of column fireproofing

6.1 COLUMNS (continued)

ITEM: 2 (Sheet 1 of 2)	**URGENCY: Routine**	**Location of Finding**
LOCATIONS: Columns in elevator shafts in 1 & 2 WTC **FINDING:** Exposed steel on column at guide rail angles Drilled holes from previously placed angles **RECOMMENDED ACTION:** Repair fireproofing per Appendix E		

DETAILED DESCRIPTION: (TYPICAL)

- fireproofing removed for guide rail angles
- exposed steel with light rust
- drilled holes from removed clip angles

ITEM 2: (Sheet 2 of 2)

PHOTOGRAPHS:

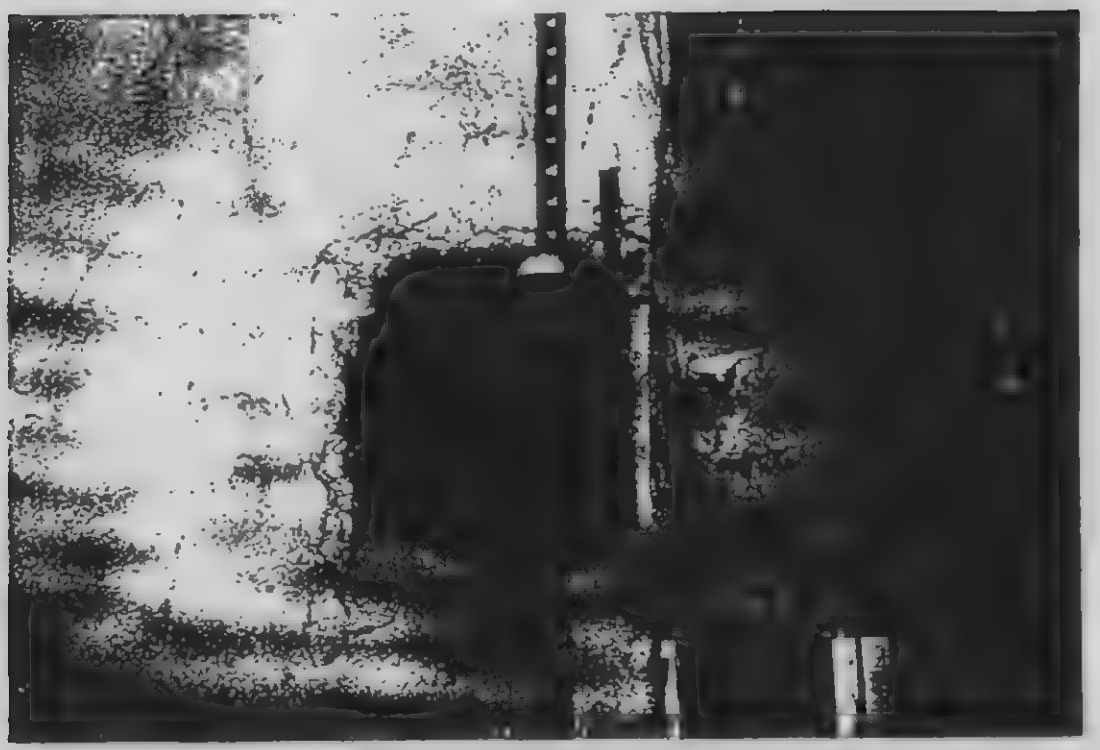


Photo 36	2WTC	Shaft 18B	Floor 36,73	Col. 605	Exposed steel due to guide rail angles Light surface rust Typical throughout shaft

Specific Locations

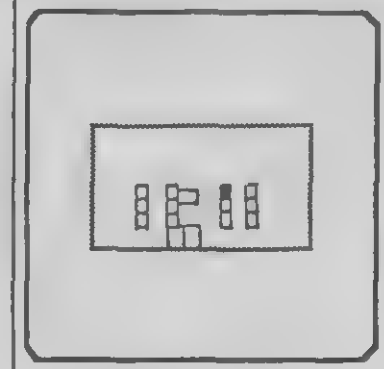
1WTC

Elev. Shaft	Column
6A	904
7A	903
17A	604

2WTC

Elev. Shaft	Column
6B	904
18B	605
20B	606
43B	702
61B	706
62B	805
96B	706

6.1 COLUMNS (continued)

ITEM: 3 (Sheet 1 of 1)	**URGENCY: Routine**	**Location of Finding**
LOCATIONS: 1WTC - Col. 706 Elev. Shaft 95A Floor 100 **FINDING:** Exposed steel at damaged drywall cant with light surface rust **RECOMMENDED ACTION:** Repair drywall cant per Appendix E, SK - 1		 TOWER 1

PHOTOGRAPH:

Photo 26

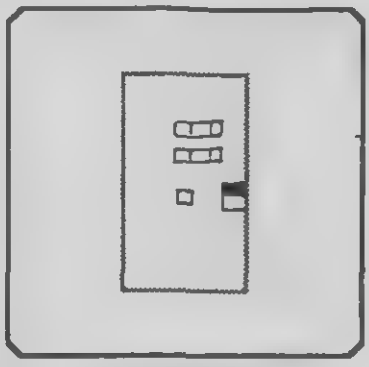
6.1 COLUMNS (continued)

ITEM: 4 (Sheet 1 of 1)	URGENCY: Routine	Location of Finding

LOCATIONS:
2WTC - Col. 904
Elev. Shaft 6B
Floor 105

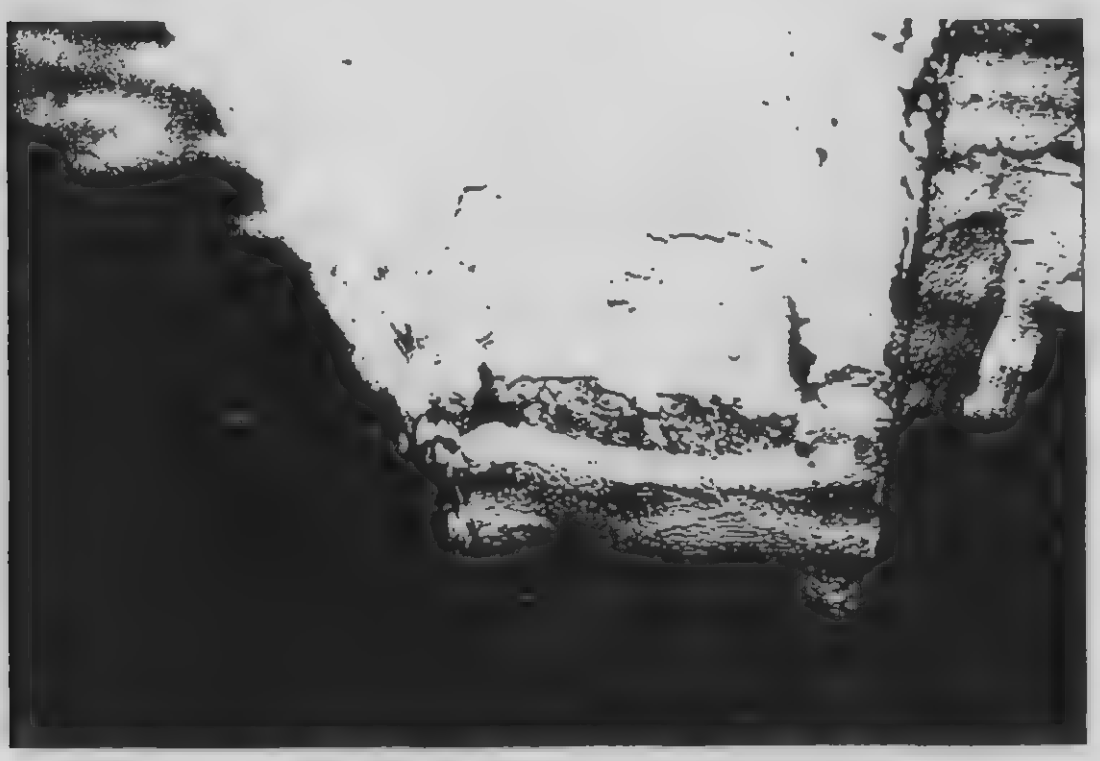
FINDING:
Exposed web of column

RECOMMENDED ACTION:
Enclose with fireproofing material, Structolite or equivalent, providing a cant of 75° angle at the column transition, per Appendix E, SK - 1

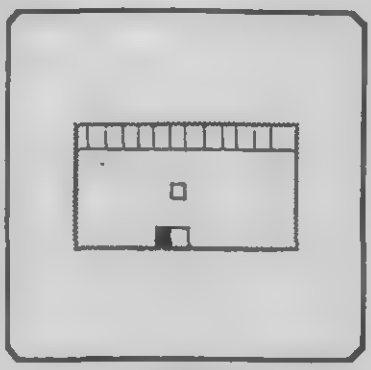


TOWER 2

PHOTOGRAPHS:
Photo 31



6.1 COLUMNS (continued)

ITEM: 5 (Sheet 1 of 1)	URGENCY: No Action	Location of Finding
LOCATIONS: 1WTC - Col. 903 Elev. Shaft 7A Floor 76 **FINDING:** Apparent water damage; Appears dry and adhesion/cohesion appears in good condition **RECOMMENDED ACTION:** No action		 TOWER 1

PHOTOGRAPHS:
Photo 3

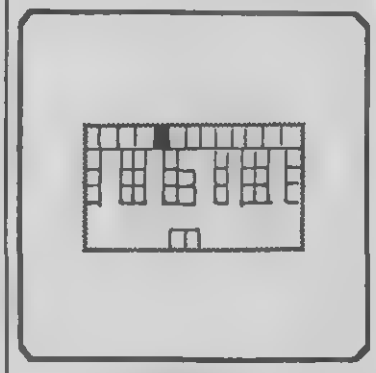
6.1 COLUMNS (continued)

ITEM: 6 (Sheet 1 of 1)	**URGENCY: No Action**	**Location of Finding**

LOCATIONS:
1WTC - Col. 603
Elev. Shaft 16A
Floor 45

FINDING:
Damage to fireproofing due to compensation cable
No exposed steel

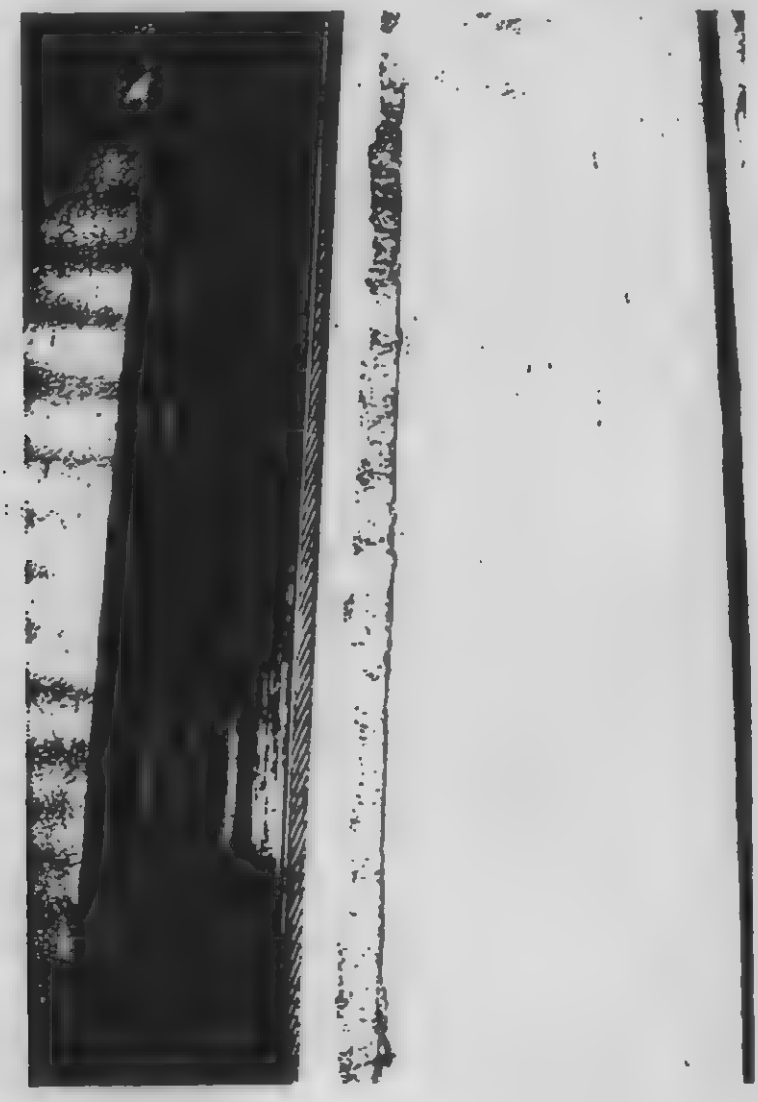
RECOMMENDED ACTION:
No action



TOWER 1

PHOTOGRAPHS:

Photo 10



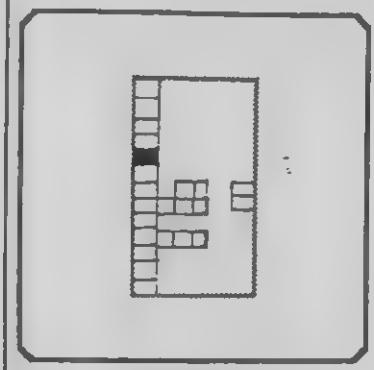
6.1 COLUMNS (continued)

ITEM: 7 (Sheet 1 of 1)	**URGENCY: No Action**	**Location of Finding**

LOCATIONS:
2WTC - Col. 605
Elev. Shaft 18B
Floor 71

FINDING:
Exposed erection bolt at column

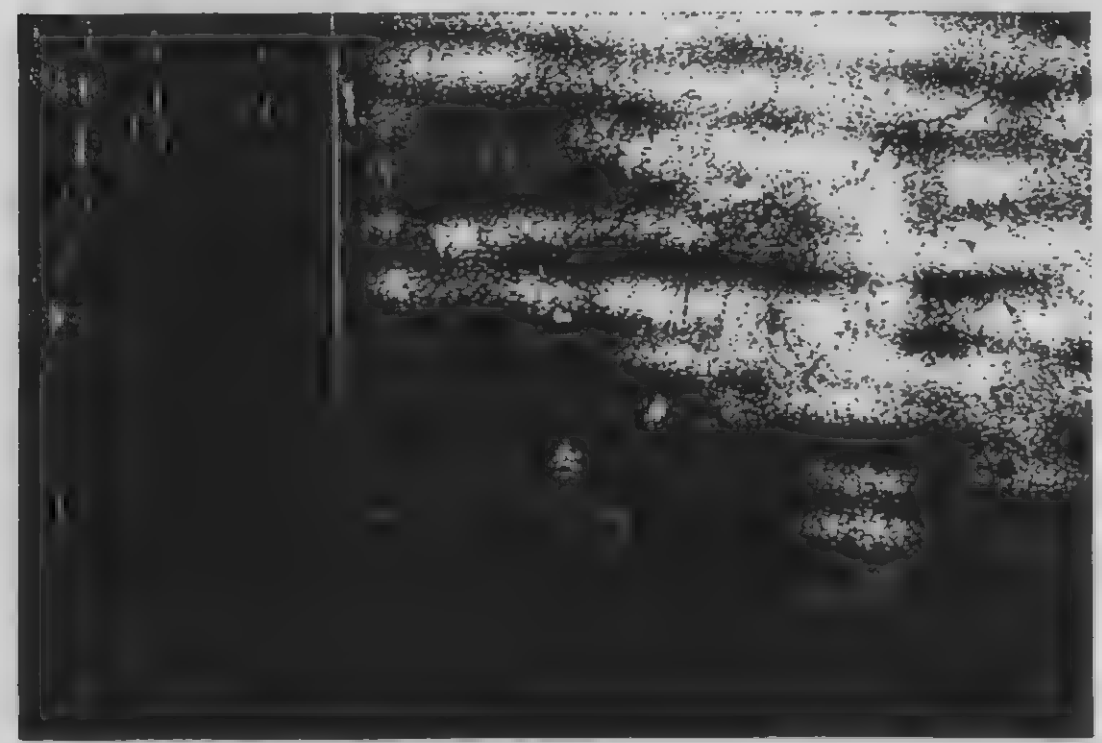
RECOMMENDED ACTION:
No action



TOWER 2

PHOTOGRAPHS:

Photo 35



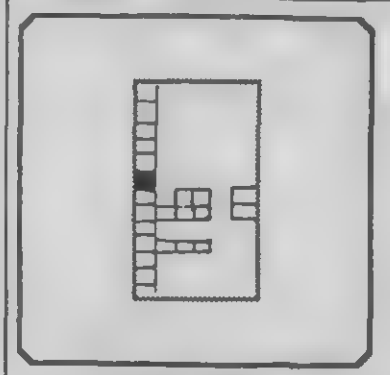
6.1 COLUMNS (continued)

ITEM: 8 (Sheet 1 of 1)	URGENCY: No Action	Location of Finding

LOCATIONS:
2WTC - Col. 605
Elev. Shaft 18B
Floor 73

FINDING:
Damage and cracking of fireproofing
No exposed steel

RECOMMENDED ACTION:
No action



TOWER 2

PHOTOGRAPHS:

Photo 37

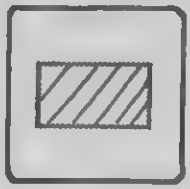
6.2 PITS

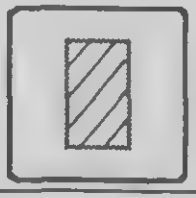
ITEM: 9 (Sheet 1 of 3)	URGENCY: Routine	Location of Finding

LOCATIONS: Elevator pits in 1 & 2 WTC

FINDING:
Exposed steel at column base with light to moderate surface rust

RECOMMENDED ACTION:
Repair fireproofing per Appendix E





SPECIFIC LOCATIONS AND DESCRIPTION

1WTC

Elev. Shaft	Floor	Column	Description of Finding
43A	B1	702	Deterioration of fireproofing from base of column Light surface rust
55A	43	707	Exposed steel at base of column approx. 1 ft. Bolts and flange exposed at column splice Moderate surface rust
61A	43	706	No fireproofing at bottom of column Connecting beams no fireproofing Moderate rust
62A	43	805	No fireproofing for one floor Light surface rust
63A	43	801	Deterioration of fireproofing from base of column Exposed steel with light surface rust
64A	43	701	Two patches of missing fireproofing at base of column at flanges
67A	42	702	Missing fireproofing at bottom of column approx. 1 Connecting beams exposed with moderate surface rust
68A	43	802	Exposed steel at base of column Moderate surface rust Elevator beam exposed with moderate rust
78A	76	707	Base of column flange exposed
79A	76	707	Deterioration of fireproofing
82A	77	801	Exposed steel at base of column approx. 5 in Light surface rust Weld rusting

ITEM: 9 (Sheet 2 of 3)

1WTC -(continued)

Elev. Shaft	Floor	Column	Description of Finding
83A	77	701	Exposed steel at base of column Moderate surface rust
89A	77	7■2	Exposed steel at base of column flanges Light surface rust Elevator beams moderate rust
94A	77	805	Exposed steel at base of column approx. 4 in. Bolts partially exposed Light surface rust
95A	77	706	Exposed steel at base of column approx. 8 in. Light rust
97A	77	806	Exposed steel at base of column web and inside flange Splice slightly exposed Light surface rust

2WTC

Elev. Shaft	Floor	Column	Description of Finding
34B	B1	706	8"x8" patch of missing fireproofing Deterioration of fireproofing at column flange edges
35B	B3	70■	Short side of box column exposed Partially patched
55B	43	905	Few inches exposed steel on column Light surface rust
56B	43	806	Moderate rust on inside of column flanges Partially exposed splice plates Missing fireproofing up to splice plate Bolt heads on splice moderate rust
63B	43	801	Approx. 5" of missing fireproofing from base of column Debris and storage area
67B	42	701	Flange exposed Light surface rust
68B	43	802	Approx. 5" missing fireproofing from column flange
78B	76	707	Exposed steel at base of column
79B	76	806	Exposed steel at base of column flange and web Light surface rust
89B	77	702	Deterioration of fireproofing at edge of column flange Light surface rust
95B	77	706	Column flange and webs exposed steel Moderate surface rust

ITEM: 9 (Sheet 3 of 3)

PHOTOGRAPHS:

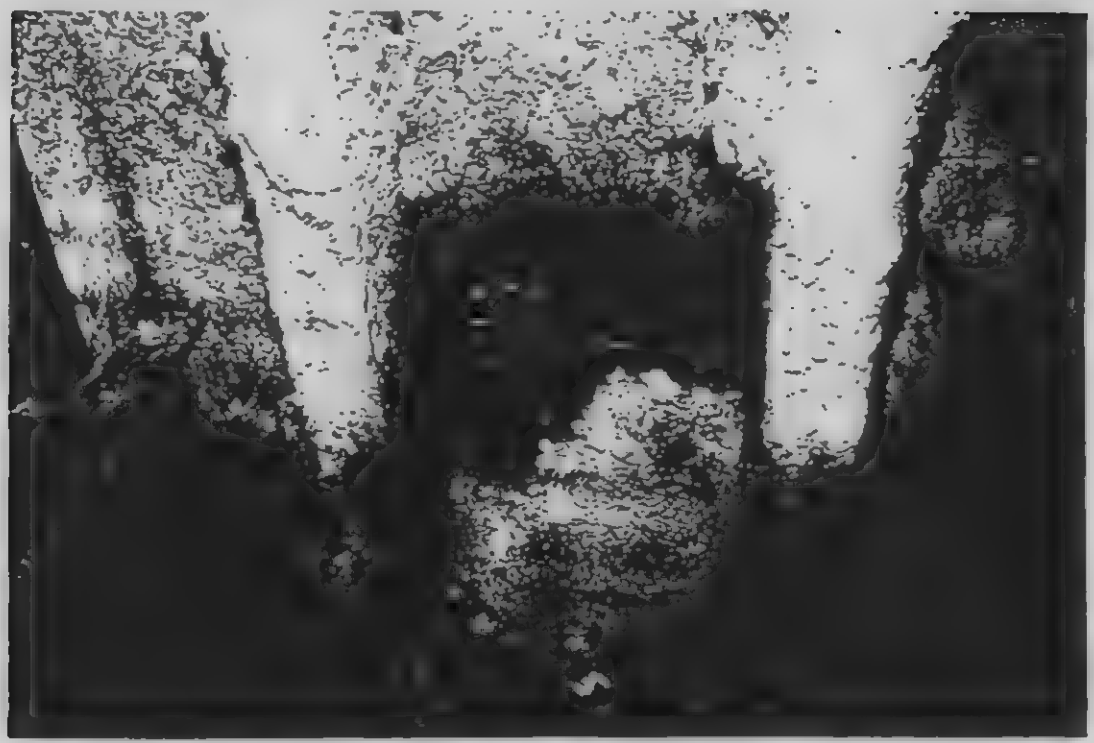
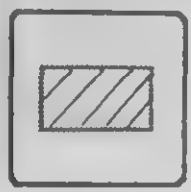
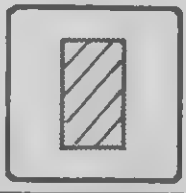


Photo 58	2WTC	Shaft 62B	Floor 43	Col. 805	Moderate surface rust Bolts partially exposed Deterioration of fireproofing

6.2 PITS (continued)

ITEM: 10 (Sheet 1 of 2)	**URGENCY: Routine**	**Location of Finding**
LOCATIONS: Elevator pits in 1 & 2 WTC **FINDING:** Exposed steel at column base with moderate surface rust and exposure continuing to floor below Moderate surface rust at the underside of flange on the partially embedded elevator beams **RECOMMENDED ACTION:** Repair fireproofing per Appendix E Enclose area of web at floor level with fireproofing Clean and paint elevator beams with zinc rich paint		 

SPECIFIC LOCATIONS AND DESCRIPTION
1WTC

Elev. Shaft	Floor	Column	Description of Finding
56A	43	806	Steel exposed at base of column approx. 8 in. Light surface rust Deterioration of fireproofing
70A	43	702	Missing fireproofing at base of column Moderate surface rust Deterioration of fireproofing

2WTC

Elev. Shaft	Floor	Column	Description of Finding
69B	43	802	Exposed steel on column Light surface rust Column web exposed to floor below
82B	77	801	Moderate surface rust at underside of the flange of the partially embedded elevator beam
96B	77	806	Exposed web of column to floor below Deterioration of fireproofing Light surface rust

ITEM: 10 (Sheet 2 of 2)

PHOTOGRAPHS:

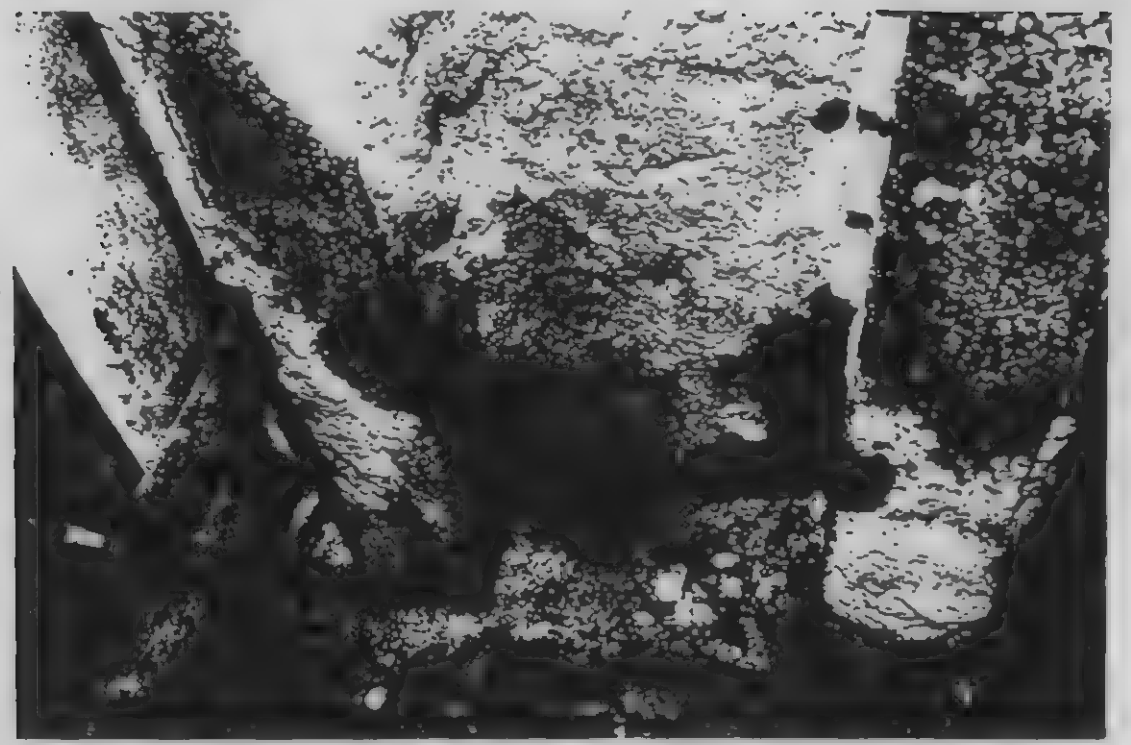
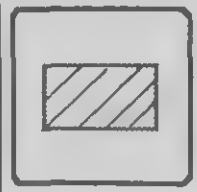


Photo 22	1WTC	Shaft 69A	Floor 43	Col. 802	Exposed column and splice Deterioration fireproofing at base of column Moderate to heavy rust Bolt heads at splice rusting

6.3 SLAB IN PITS

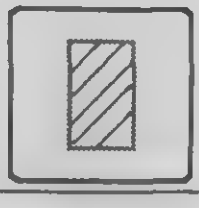
ITEM: 11 (Sheet 1 of 1)	URGENCY: No Action	Location of Finding

LOCATIONS:
Elevator pits in 1 & 2 WTC
Floor 42/43 and 76/77



FINDING:
Rough surface condition at top of slab

RECOMMENDED ACTION:
No action



PHOTOGRAPHS:

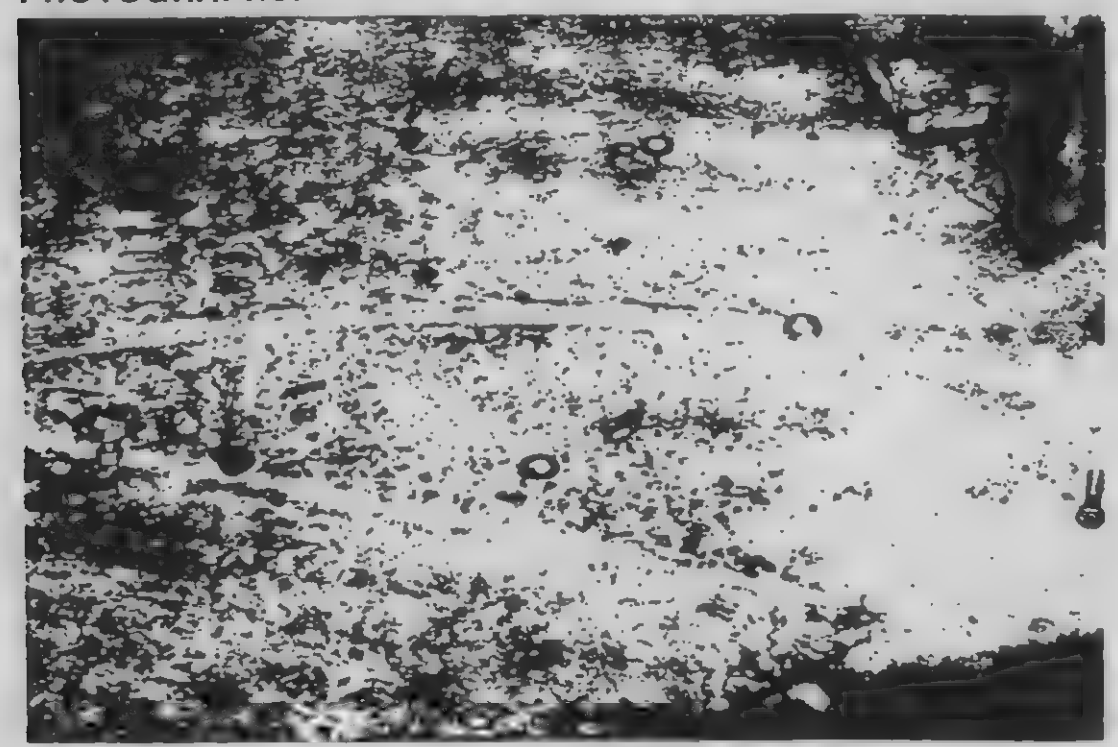


Photo 68	2WTC	Shaft 95B	Floor 77	Col. 706	Rough slab surface

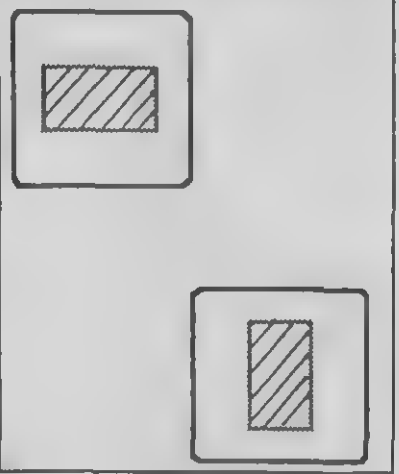
6.4 CONNECTING BEAMS

ITEM: 12 (Sheet 1 of 6)	URGENCY: Routine	Location of Finding

LOCATIONS:
Connecting beams to columns in elevator shafts of 1 & 2 WTC

FINDING:
Exposed steel at webs and flanges of connecting beams

RECOMMENDED ACTION:
Repair fireproofing per Appendix E



SPECIFIC LOCATIONS AND DESCRIPTIONS

1WTC

Elev. Shaft	Floor	Column	Description of Finding
34A	22, 23	706	Exposed steel at top and bottom of connection beams with varying degree of missing fireproofing
35A	11,17	805	Exposed connecting beam behind chicken wire covering
42A & 43A	-	802/702	Exposed steel at connecting beams Light rust Typical throughout shaft
61A & 62A	-	706/805	Connecting beams missing patches of fireproofing less than 3 square inches Typical throughout shaft
69A &70A	-	802/702	Connecting beams missing fireproofing from guide rail or chicken wire attachments Typical throughout shaft
78A	76	707	Connecting beams moderate rust
79A	76	707	Connecting beam rusting with exposed bottom flange
89A	B3 - B1	702	Connecting beams, web and bottom of flanges exposed
96A & 97A	-	707/806	Connecting beams missing fireproofing Typical throughout shaft

ITEM: 12 (Sheet 2 of 6)

2WTC

Elev. Shaft	Floor	Column	Description of Finding
7B	-	903	Counterweight cables deteriorating fireproofing at cross beams Typical condition at all floors
18B	3	605	Deterioration of fireproofing at bolts and flange on connecting beam
18B	13	605	Exposed steel on connecting beams Light surface rust
19B	-	606	Exposed steel at connecting beam with varying amount of deterioration Exposed steel with light surface rust Typical condition throughout shaft
20B	12,13	606	Deterioration of connecting beam left by counterweight cable Black markings due to cable Exposed steel light surface rust
20B	74	606	Exposed steel at connecting beam, deterioration of fireproofing due to counterweight cables.
20B	55,57,62,67, 70,77	606	Connecting beam, small area of exposed steel
34B	24	706	Top of shaft, beam no fireproofing Connecting beam missing fireproofing at flange top and underside Light rust
42B	32	702	Seated beam connection plate partially exposed
43B	40	702	Exposed steel on connecting beam Light surface rust Duct tape on beam
43B	-	702	Missing fireproofing on connecting beams Typical throughout shaft
61B & 62B	-	706/805	Connecting beams missing fireproofing Typical throughout shaft
■■B	-	802	Small patches of steel exposed less than one square inch of area on beams and columns Typical throughout shaft
89B	82,91,96 & up	702	Deterioration of fireproofing at bottom flange connection to column, varying degrees of deterioration of fireproofing
89B	93	802	Connecting beam exposed behind cable and chicken wire
89B	-	802	Deterioration of fireproofing of bolts at bottom flange of beam at column connection Typical throughout shaft
■■B	77	706	Exposed steel at bottom flange of connecting beam Bolts on beam exposed

ITEM: 12 (Sheet 3 of 6)
PHOTOGRAPHS:

Photo 27

1 WTC

Shaft 95A

Floor 80, 107

Col. 706

Deterioration of fireproofing exposing bolts heads on connecting beams

ITEM: 12 (Sheet 4 of 6)

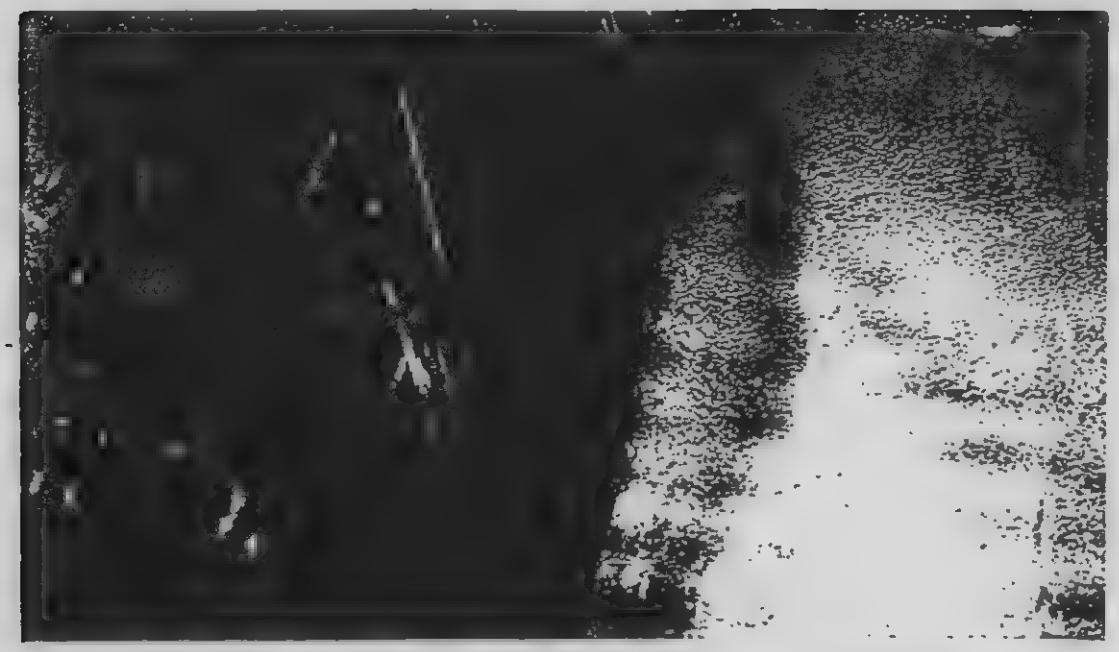


Photo ▨	2WTC	Shaft 6B	Floor 60 Sim at 101	Col. 904	Water damage to fireproofing Plate and underside of beam exposed

Photo 29	2WTC	Shaft 6B	Floor 75	Col. 904	Connecting beam end exposed Light surface rust

ITEM: 12 (Sheet 5 of 6)

Photo 30	2WTC	Shaft 6B	Floor 86	Col. 904	Damage to concrete encasement of beam Exposed steel Cable attachment to column

Photo 38	2WTC	Shaft 18B	Floor 13	Col. 605	Deterioration of fireproofing at beams Exposed steel with light surface rust Paper stuffed at beam connection

ITEM: 12 (Sheet 6 of 6)

Photo 42	2WTC	Shaft 20B	-	Col. -	Deterioration of fireproofing due to counterweight cable Exposed steel with light surface rust Typical throughout shaft

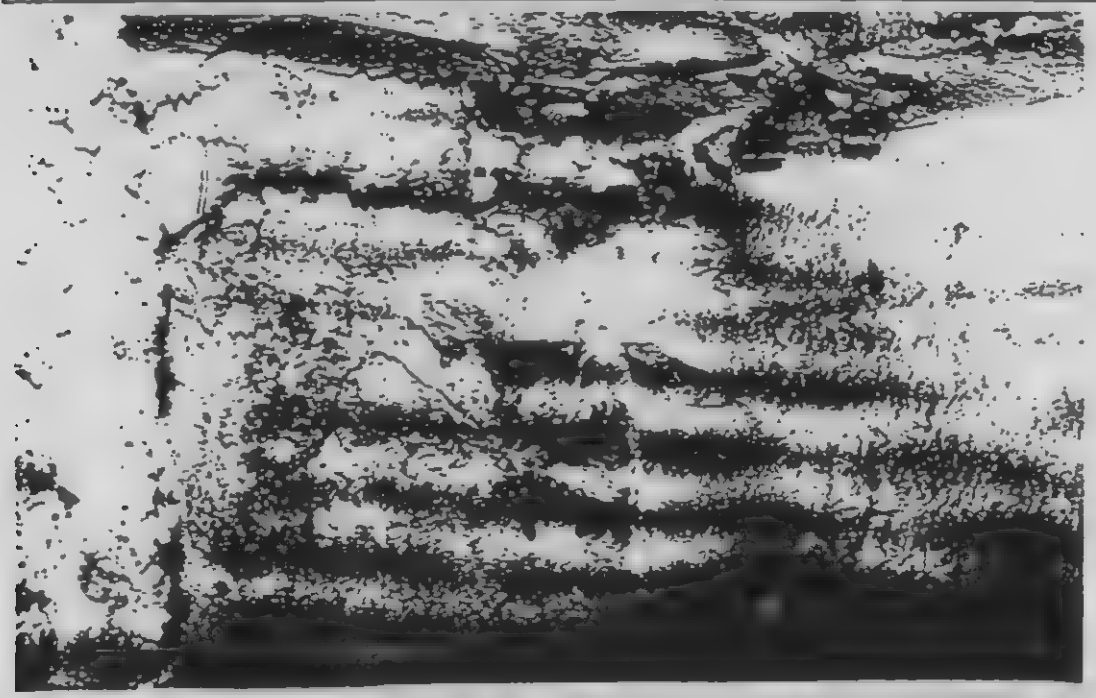


Photo 64	2WTC	Shaft 89B	82	Col. 702	Deterioration of fireproofing at beam intersection at corner of shaft Bolts and web of beams exposed Typical throughout shaft

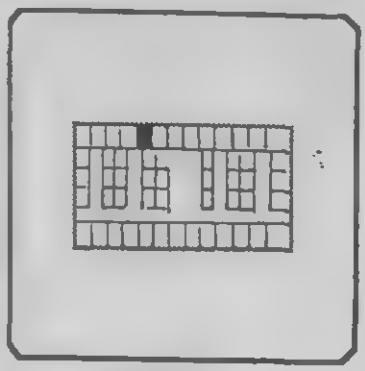
6.4 CONNECTING BEAMS - (continued)

ITEM: 13 (Sheet 1 of 2)	**URGENCY: Routine**	**Location of Finding**

LOCATIONS:
1WTC - Col. 603
Elev. Shaft 16A
Floor 8
Typical throughout shafts

FINDING:
Deterioration of erection bolt ends and fireproofing on connecting beams due to rubbing of the compensation rope

RECOMMENDED ACTION:
Repair fireproofing per Appendix E
PANYNJ to eliminate or reduce cable sway using a cable damping device



TOWER 1

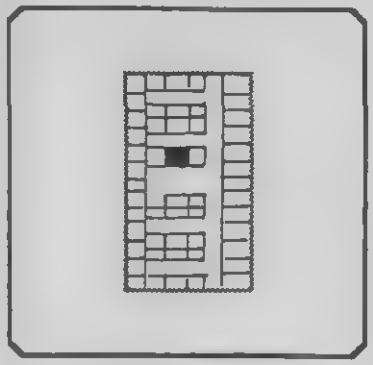
PHOTOGRAPHS:

Photo 4	Deterioration of fireproofing on connecting beam due to compensation rope rubbing against beam and bolt ends Steel plate partially exposed with light surface rust

ITEM: 13 (Sheet 2 of 2)

Photo 8	Exposed steel with light rust at column, connection plate and connecting beam Deterioration of fireproofing on beam due to compensation rope Varying degree of damage to beam fireproofing throughout the shaft

6.4 CONNECTING BEAMS (continued)

ITEM: 14 (Sheet 1 of 6)	URGENCY: Priority	Location of Finding
LOCATIONS: 2WTC Elev. Shaft 34B Bottom of Floor 9 & Floor 10 **FINDING:** Web of beams warped. **RECOMMENDED ACTION:** Beam testing by laboratory Add stiffeners to web of beam as a minimum repair per Fig. 14		 TOWER 2

DESCRIPTION:
We observed damage to the web and bottom flange of the beams located in 2 WTC, elevator shaft 34B. The beams are located at the bottom of floor 9 and the bottom of floor 10. The east end of the beam at the bottom of floor 10, there are 3 locations of web warping (See Fig. 14-3).

Plate attachments are welded to existing beams located at the bottom of floor 9 and the bottom of floor 10. In speaking with PA personnel, the plate attachments may have been a remedial repair to support the shaft wall. We assume this repair was completed under PA supervision.

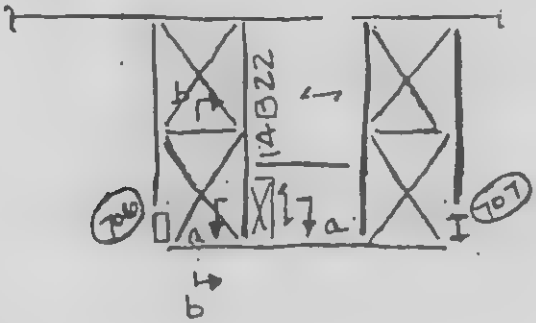
RECOMMENDED ACTION:
The beams were checked for loading conditions and are found to be adequate. The cause of the damage to the beam is unknown. The damage may be caused by an unknown force on the other side of the beam which should be investigated (See Fig. 14.2). In speaking with PA personnel, another possibility is a fire in the 70's may have been a cause of the beam warping.

Due to the uncertainty of events that may have caused the damage to the beams, we recommend the beams be tested by a laboratory to determine if the strength and metallurgy of the beams were affected by a fire. Testing which can be done are a field hardness test as well as taking a sample from the beam approximately 2-1/2" x 10" long. From the plate sample, a tensile test and metalography test can be done.

From the test results, we can then provide an appropriate repair for the beams if required but as a minimum repair, we recommend adding stiffeners as shown on Fig. 14-4.

ITEM: 14 (Sheet 2 of 6)
PHOTOGRAPHS:
Photo 47

REV.	LERA LESLIE E. ROBERTSON ASSOCIATES, RLLP CONSULTING STRUCTURAL ENGINEERS	P1133902	DRAWING NO.
	S1196 - ACCESSIBLE COLUMNS	DRAFT	FIG 14-1
	ELEV 34B BOTTOM OF FL9 & BOTTOM OF FL.10 PLAN	DESIGN ES	
		CHECK	3MAY96

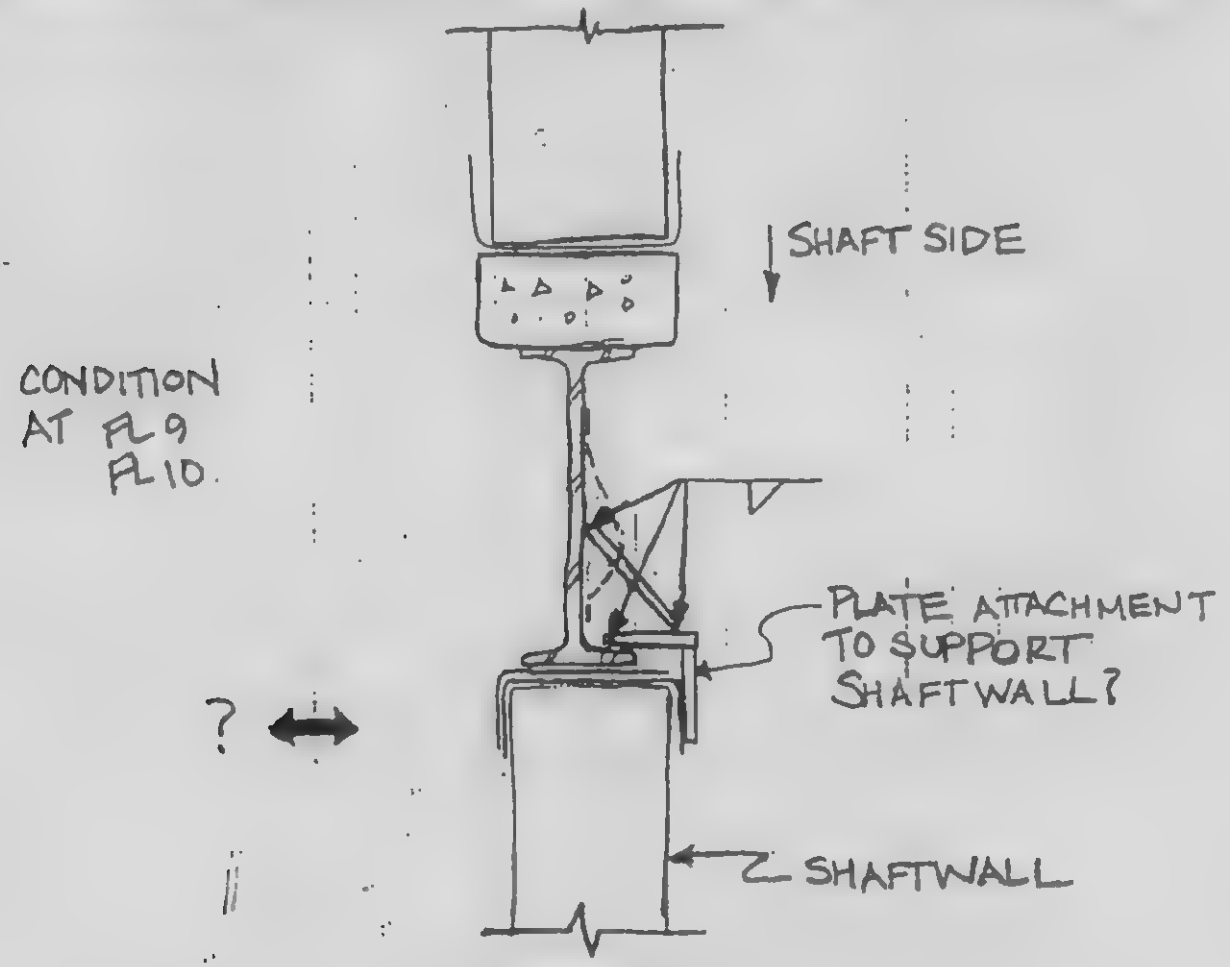


14B22
FY 36 FL10
FY 50 FL9

PART PLAN FL9 & FL10
2WTC

- FOR EXISTING SECTION - SEE 14-2
  14-3
- FOR REPAIR SECTION - SEE 14-4

REV.	LERA LESLIE E. ROBERTSON ASSOCIATES, RLLP CONSULTING STRUCTURAL ENGINEERS	P 1133902	DRAWING NO.
	S1196 - ACCESSIBLE COLUMNS	DRAFT	FIG 14-2
	ELEV 34B BOTTOM OF FL 9 & BOTTOM OF FL 10	DESIGN ES	
	CROSS SECTION	CHECK	1 MAY 96

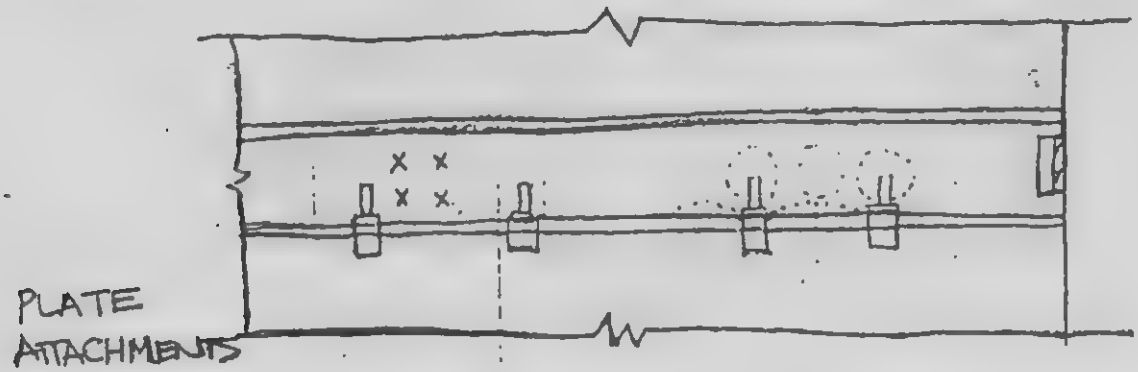


SECTION a-a

POSSIBLE CAUSE OF WEB WARPING

- UNKNOWN FORCE ACTING ON OTHER SIDE OF SHAFTWALL
- WARPING CAUSED BY FIRE IN THE 70's.

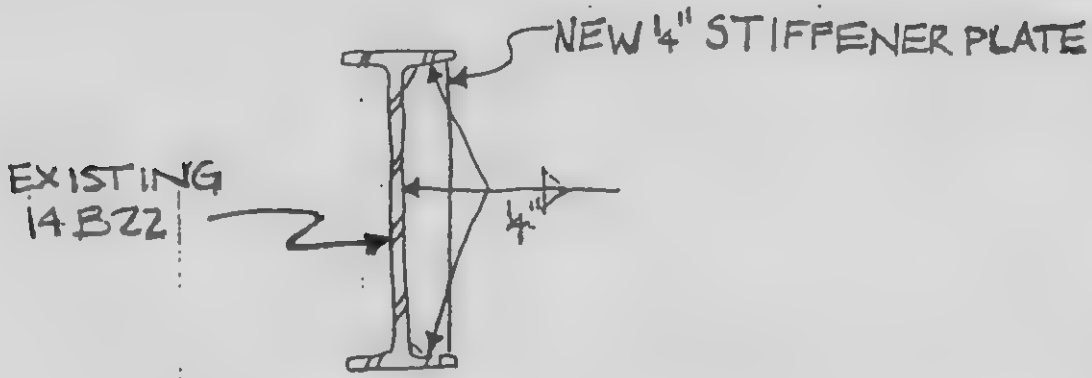
REV.	LERA LESLIE E. ROBERTSON ASSOCIATES, RLLP CONSULTING STRUCTURAL ENGINEERS	P1133902	DRAWING NO.
	5/1/96 - ACCESSIBLE COLUMNS	DRAFT	FIG.14-3
	ELEV. 34B FL9 & FL10	DESIGN E S	
	BEAM REINFORCEMENT	CHECK	2 MAY 96



--- LINE OF WARPING
SECTION b-b

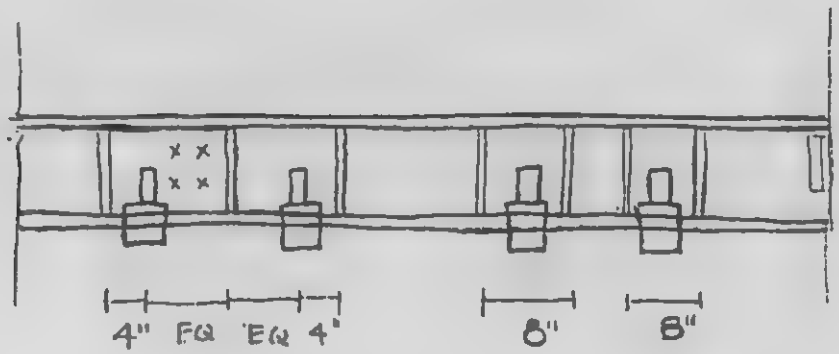
EXISTING CONDITION @ FL.10

REV.	LERA LESLIE E. ROBERTSON ASSOCIATES, RLLP CONSULTING STRUCTURAL ENGINEERS	P 1133902	DRAWING NO.
	S1196 - ACCESSIBLE COLUMNS	DRAFT	FIG 14-4
	ELEV 34B BOTTOM OF FL 9 & BOTTOM OF FL 10	DESIGN ES	
	REPAIR SECTIONS	CHECK	2 MAY 96



SECTION a-a

RECOMMENDED REPAIR



SECTION b-b

LOCATION OF STIFFENERS FOR REPAIR AT BOTTOM OF FL 9 & BOTTOM OF FL 10

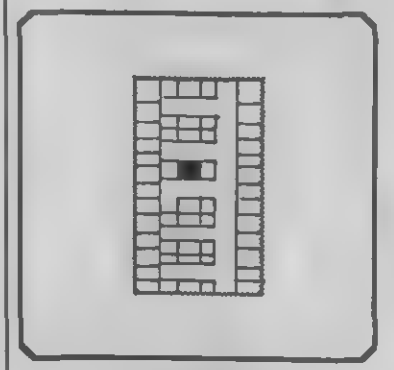
6.4 CONNECTING BEAMS (continued)

ITEM: 15 (Sheet 1 of 1)	URGENCY: Routine	Location of Finding

LOCATIONS:
2WTC - Col. 706
Elev. Pit 61B
Floor 43

FINDING:
Fire protection appears to be compromised due to reworking of wall

RECOMMENDED ACTION:
Fire rating should be investigated
Repair wall where fire rating of wall has been compromised



TOWER 2

PHOTOGRAPHS:

Photo 55

Top portion of bracing at beam

7. SUMMARY OF REPAIRS ITEMS

The following is a summary of the items we recommend for repairs in section 6. Section 6 of this report provide for each item a detailed description, exact locations of findings, recommended action, and photographs. It also defines the urgency categories (immediate, priority, routine).

7.1 IMMEDIATE REPAIR ITEMS

No immediate repair items were found

7.2 PRIORITY REPAIR ITEMS

ITEM	DESCRIPTION	LOCATION
14	Beam testing by laboratory Add stiffeners to web of beam as a minimum repair per Fig. 14	2WTC Elev. Shaft 34B Bottom of Floor 9 & Floor 10

7.3 ROUTINE REPAIR ITEMS

ITEM	DESCRIPTION	LOCATION
1	Repair fireproofing per Appendix E	Throughout all shafts
2	Repair fireproofing per Appendix E	Throughout all shafts
3	Repair drywall cant per Appendix E, SK - 1	1WTC - Col. 706 Elev. Shaft 95A Floor 100
4	Enclose with fireproofing material, Structolite or equivalent providing a cant of 75° angle at the column transition, per Appendix E, SK - 1	2WTC - Col. 904 Elev. Shaft 6B Floor 105
9	Repair fireproofing per Appendix E	Throughout all elevator pits
10	Repair fireproofing per Appendix E Enclose area of web at floor level with fireproofing Clean and paint elevator beams with zinc - rich paint	Elevator Pits 56A,69A,70A,69B,96B
12	Repair fireproofing per Appendix E	Throughout all shafts
13	Repair fireproofing per Appendix E PANYNJ to eliminate or reduce cable sway using a cable damping device	1WTC - Col. 603 Elev. Shaft 16A Floor 8 Typical throughout shafts
15	Investigate fire rating. Repair wall where fire rating of wall has been compromised	2WTC - Col. 706 Elev. Pit 61B Floor 43

8. CONCLUSIONS

Based on our observation and our evaluations of the inspection, we believe that the structural integrity of the accessible columns is good within the selected elevator shafts.

We recommend the following three actions for repair.

1. All areas of exposed steel on columns and beams in the shafts and pits inspected within this report to be cleaned and fire protected.

2. As a priority repair, the further investigation and testing of the warped beams in elevator shaft 34B.

3. PANYNJ to eliminate or reduce the cable sway by a cable damping device where feasible to protect both the connecting beams and cables from subjected to continual rubbing.

9. LIMITATIONS OF REPORT

The opinions expressed in this report represent our professional view, based on the information made available to us. In developing these opinions, we have exercised a degree of care and skill commensurate with that exercised by reputable structural engineers of this location. No other warranty, expressed or implied, is made as to the professional advice included in this report.

We appreciate this further opportunity to assist the Port Authority of New York and New Jersey.

Please call us for any questions you may have.

Sincerely,

Eiko Shimazu

LERA

APPENDIX A

LIST OF ARCHITECTURAL PLANS

LERA

LIST OF ARCHITECTURAL PLANS

Drawing No.	Title
A•A•20	1ST FLOOR CORE PLAN (1 WTC)
A•A•73	44TH FLOOR CORE PLAN (1 WTC)
A•A•131	78TH FLOOR CORE PLAN (1 WTC)
A•A•164	106TH FLOOR CORE PLAN (1 WTC)
A•B•21	1ST FLOOR CORE PLAN (2 WTC)
A•B•79	44TH FLOOR CORE PLAN (2 WTC)
A•B•137	78TH FLOOR CORE PLAN (2 WTC)
A•B•170	106TH FLOOR CORE PLAN (2 WTC)

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APPENDIX B

PHOTOGRAPHS LISTING

LERA

17 May 1996
File: 1133902

Photograph Listing of 1 WTC

Photo No.	Location	Existing Conditions	Item No
1	1WTC - Col. 904 Elev. Shaft 6A Floor 77	Deterioration of fireproofing. at column transition Exposed steel Moderate surface rust	1
2 -	1WTC - Col. 904 Elev. Shaft 6A Floor 49	Exposed steel with unknown plate attachment Light surface rust	1
- Sim to Photo 36 &37	1WTC - Col. 904 Elev. Shaft 6A	Exposed surfaces at removed or existing guide rail angles with light surface rust Drilled holes in column due to guide rail angles supports Typical throughout shaft	2
3	1WTC - Col. 903 Elev. Shaft 7A Floor 76	Water damage evident on fireproofing; appears dry	5
3 SIM	1WTC - Col. 903 Elev. Shaft 7A	Exposed steel at guide rail angle Typical throughout shaft	2
4	1WTC - Col. 603 Elev. Shaft 16A Floor 8	Deterioration of fireproofing on connecting beam due to compensation rope rubbing against beam and bolt ends Steel plate partially exposed Light surface rust	13
5	1WTC - Col. 603 Elev. Shaft 16A Floor 8	Close up of bolt ends Bolt end flush with nut Varying degrees of damage throughout shaft	13
6	1WTC - Col. 603 Elev. Shaft 16A Floor 15	Exposed plate with light rust Black markings are evidence of ropes rubbing against plate Typical throughout shaft	13
7	1WTC - Col. 603 Elev. Shaft 16a Floor 15	Close up of connecting beam Deterioration of fireproofing Markings left by ropes	13
8	1WTC - Col. 603 Elev. Shaft 16A Floor 26	Exposed steel at column and connecting beam Deterioration of fireproofing on beam due to compensation rope Varying degree of damage to beam fireproofing throughout the shaft	13
9	1WTC - Col. 603 Elev. Shaft 16A Floor 26 Looking Up Similar condition Floor 27,28,43,56	Exposed steel on column and connecting beams Light rust	1
10	1WTC - Col. 603 Elev. Shaft 16A Floor 45	Damage to fireproofing from compensation cable	6
-	1WTC - Col. 604 Elev. Shaft 17A Floor 1	Exposed steel at column for one floor Light rust	1
-	1WTC - Col. 604 Elev. Shaft 17A	Exposed steel from guide rail angles typical throughout shaft	2

Photograph Listing of 1 WTC

Photo No.	Location	Existing Conditions	Item No
11	1WTC - Col. 706 Elev. Shaft 34A Floor 15	Exposed steel on column Light surface rust	1
12, 13, 14	1WTC -Col. 706 Elev. Shaft 34A Floor 22, 23 for Photo 14	Exposed steel at top and bottom of connecting beams with varying degrees of missing fireproofing Typical at all elevator shafts	12
15,16	1WTC - Col. 805 Elev. Shaft 35a Floor 6 Photo 15 Floor 7 Photo 16	Exposed steel full floor height at floor 6 Deterioration of column fireproofing at floor 7 Light surface rust	1
17,18	1WTC - Col. 805 Elev. Shaft 35A Floor 11 Photo 17 Floor 17 Photo 18	Exposed connecting beam behind chicken wire covering	12
- Sim Photo 12-14	1WTC - Col. 802 & Col. 702 Elev. Shaft 42A & Shaft 43A	Exposed steel at connecting beams Light rust Typical throughout shaft	12
19	1WTC - Col. 702 Elev. Pit 43A Level B1	Deterioration of fireproofing from base of column Light surface rust	9
- Sim Photo 58	1WTC - Col. 707 Elev. Pit 55A Floor 43	Exposed steel at base of column approx. 1 ft. Bolts and flange exposed at column splice Moderate surface rust	9
- Sim Photo 23	1WTC - Col. 806 Elev. Pit 56A Floor 43	Exposed steel at base of column approx. 8 in. Light surface rust Deterioration of fireproofing	10
-	1WTC - Col. 706 & Col. 805 Elev. Shaft 61A & Shaft 62A	Connecting beams missing patches of fireproofing less than 3 square inches Typical throughout shaft	12
- Sim Photo 58	1WTC - Col. 706 Elev. Pit 61A Floor 43	No fireproofing at bottom of column Connecting beams no fireproofing Moderate rust	9
-	1WTC - Col. 805 Elev. Pit 62A Floor 43	No fireproofing for one floor Light surface rust	9
20	1WTC - Col. 801 Elev. Pit 63A Floor 43	Deterioration of fireproofing from base of column Exposed steel with light surface rust	9
-	1WTC - Col. 701 Elev. Shaft 64A Floor 43	Two patches of missing fireproofing at base of column at flanges	9
- Sim Photo 20	1WTC - Col. 702 Elev. Pit 67A Floor 42	Missing fireproofing at base of column approx. one foot Connecting beams exposed with moderate surface rust	9
21	1WTC - Col. 802 Elev. Pit 68A Floor 43	Exposed steel at base of column Moderate surface rust Elevator beam exposed with moderate rust	9

Photograph Listing of 1 WTC

Photo No.	Location	Existing Conditions	Item No
22	1WTC - Col. 802 Elev. Pit 69A Floor 43	Exposed column and splice Deterioration fireproofing at base of column Moderate to heavy rust Bolt heads at splice rusting	10
-	1WTC - Col. 802 & Col. 702 Elev. Shaft 69A & Shaft 70A	Small patches of fireproofing missing from columns Typical throughout shaft	1
-	1WTC - Col. 802 & Col. 702 Elev. Shaft 69A & Shaft 70A	Connecting beams missing fireproofing from guide rail or chicken wire attachments Typical throughout shaft	12
23	1WTC - Col. 702 Elev. Pit 70A Floor 43	Missing fireproofing at base of column Moderate surface rust Deterioration of fireproofing	10
-	1WTC - Col. 707 Elev. Pit 78A Floor 76	Base of column flange exposed	9
-	1WTC - Col. 707 Elev. Pit 78A Pit 79A Floor 76	Connecting beams moderate rust Pit 78A Connecting beam rusting with exposed bottom flange Pit 79A	12
-	1WTC - Col. 707 Elev. Pit 79A Floor 76	Deterioration of fireproofing	9
- Sim Photo 24	1 WTC - Col. 801 Elev. Pit 82A Floor 77	Exposed steel at base of column approx. 5 in Light surface rust weld is also rusting	9
24	1WTC - Col. 701 Elev. Pit 83A Floor 77	Exposed steel at base of column Moderate surface rust	9
-	1WTC - Col. 802 Elev. Shaft 88A Floor 91	Column Steel exposed 3 sq. in of area Light surface rust	1
-	1WTC - Col. 702 Elev. Shaft 89A Level B3-B1	Connecting beams, web and bottom of flanges exposed	12
25	1WTC - Col. 702 Elev. Pit 89A Floor 77	Exposed steel at base of column flanges Light surface rust Elevator beams moderate rust	9
-	1WTC - Col. 805 Elev. Pit 94A Floor 77	Exposed steel at base of column approx. 4 in. Bolts partially exposed Light surface rust	9
26	1WTC - Col. 706 Elev. Shaft 95A Floor 100	Column flange exposed due to damage of sheet rock	3
-	1WTC - Col. 706 Elev. Shaft 95A Floor 98 - 100	Light surface rust Patches less than 1 in. Sq. Area missing fireproofing	1

Photograph Listings of 1 WTC

Photo No.	Location	Existing Conditions	Item No
27	1WTC - Col. 706 Elev. Shaft 95A Floor 80,107	Deterioration of fireproofing exposing bolts heads on connecting beams	12
-	1WTC - Col. 706 Elev. Pit 95A Floor 77	Exposed steel at base of column approx. 8 in. Light rust	9
-	1WTC - Col. 707 Col. 806 Elev. Shaft 96A Shaft 97A	Connecting beams missing fireproofing Typical throughout shaft	12
-	1WTC - Col. 806 Elev. Pit 97A Floor 77	Steel exposed at base of column web and inside flange Splice slightly exposed Light surface rust	9
28	2WTC - Col. 904 Elev. Shaft 6B Floor 60 Similar exposure at floor 101	Water damage to fireproofing Plate and underside of beam exposed	12
29	2WTC - Col. 904 Elev. Shaft 6B Floor 75	Connecting beam end exposed Light surface rust	12
30	2WTC - Col. 904 Elev. Shaft 6B Floor 86	Damage to concrete encasement of beam Exposed steel Cable attachment to column	12
31	2WTC - Col. 904 Elev. Shaft 6B Floor 105	Exposed web of column	4
-	2WTC - Col. 904 Elev. Shaft 6B	Exposed steel at removed angles for guide rails Typical condition at all floors	2
-	2WTC - Col. 903 Elev. Shaft 7B	Counterweight cables deteriorating fireproofing at cross beams Typical condition at all floors	12
32	2WTC - Col. 605 Elev. Shaft 18B	Cables hitting sheet rock and leaving marks Exposed steel at removed guide rail angles Typical condition at all floors	2
33	2WTC - Col. 605 Elev. Shaft 18B Floor 3	Column flange exposed Light surface rust	1
33 SIM	2WTC - Col. 605 Elev. Shaft 18B Floor 3	Deterioration of fireproofing at bolts and flange on connecting beam	12
34	2WTC - Col. 605 Elev. Shaft 18B Floor 13	Exposed steel on connecting beams Light surface rust	12
35	2WTC - Col. 605 Elev. Shaft 18B Floor 71	Bolt exposed at column	7

Photograph Listing Of 2 WTC

Photo No.	Location	Existing Conditions	Item No
36	2WTC - Col. 605 Elev. Shaft 18B Floor 36	Exposed steel due to guide rail angle Light surface rust Some areas where guide rails have been removed therefore drilled holes from angle supports remain Typical condition at all shafts	2
37	2WTC - Col. 605 Elev. Shaft 18B Floor 73	Exposed steel due to guide rail angle Damage and cracking to fireproofing Typical condition throughout shaft	8
38	2WTC - Col. 605 Elev. Shaft 18B Floor 13	Deterioration of fireproofing at connecting beams Exposed steel with light surface rust Paper stuffed at beam connection	12
39	2WTC - Col. 606 Elev. Shaft 19B Floor 2	Missing fireproofing from column Light surface rust	1
40	2WTC - Col. 606 Elev. Shaft 19B Floor 5 Similar condition Floors 46,55,73	Exposed steel for full width of the column ranging from a few feet to 6 ft. In height Exposed connecting beam varying amount of deterioration Light surface rust	1 & 12
41	2WTC - Col. 606 Elev. Shaft 19B Typical condition throughout shaft	Exposed steel at connecting beam Exposed steel Light surface rust	12
42	2WTC - Col. 606 Elev. Shaft 20B	Deterioration of connecting beam due to counterweight cable Exposed steel with light surface rust Typical condition throughout shaft	12
43	2WTC - Col. 606 Elev. Shaft 20B Floor 12 & 13	Deterioration of connecting beam left by counterweight cable Black markings due to cable Exposed steel light surface rust	12
44	2WTC - Col. 606 Elev. Shaft 20B Floor 22 Similar condition Floors 47,57,64	Exposed steel on column approx. full floor height and width Light surface rust	1
45	2WTC - Col. 606 Elev. Shaft 20B Floor 74	Exposed steel on connecting beam, deterioration of fireproofing due to counterweight cables	12
-	2WTC - Col. 606 Elev. Shaft 20B Floor 55,57,62,67,70,77	Guide rail angle exposed, typical throughout shaft Connecting beam, small area of steel exposed	2 & 12
-	2WTC - Col. 606 Elev. Shaft 20B Floor 49	Deterioration of fireproofing from column	1
46	2WTC - Col. 607 Elev. Shaft 21B Floor 21	Exposed steel on column approx. Full floor height and width Light surface rust	1

Photograph Listing of 2 WTC

Photo No.	Location	Existing Conditions	Item No
-	2WTC - Col. 706 Elev. Shaft 34B Floor 24	Top of shaft, beam no fireproofing Connecting beam missing fireproofing at flange top and underside Light rust	12
-	2WTC - Col. 706 & Col. 805 Elev. Shaft 34B & Shaft 35B	Columns missing small patches of fireproofing Typical throughout shaft	1
47, 48	2WTC - Col. - Elev. Shaft 35B Floor 10 (Sim at 9)	Web of beams warped (east end) Photo 47 (west end) Photo 48	14
-	2WTC - Col. 706 Elev. Pit 34B Floor B1	8"x8" patch of missing fireproofing Deterioration of fireproofing at column flange edges	9
-	2WTC - Col. 706 Elev. Pit 35B Floor B3	Short side of box column exposed Partially patched	9
49	2WTC - Col. 702 Elev. Shaft 42B Floor 32	Seated beam connection plate partially exposed	12
50	2WTC - Col. 702 Elev. Shaft 43B Floor 6	Small area of exposed steel approx. 3 sq. in Light surface rust	1
51	2WTC - Col. 702 Elev. Shaft 43B Floor 40	Exposed steel on connecting beam Light surface rust Duct tape on beam	12
-	2WTC - Col. 702 Elev. Shaft 34B Floor 23	Column web exposed Heavy surface rust	1
-	2WTC - Col. 702 Elev. Shaft 43B Typical throughout shaft	Missing fireproofing on connecting beams Guide rail angles exposed steel	12 & 2
52	2WTC - Col. 905 Elev. Pit 48B Level B3	Missing fireproofing from column Rusting selector tape appears to be deteriorating the fire protection	1
53	2WTC - Col. 905 Elev. Pit 48B Level B3	Missing fireproofing on column Debris at pit level	1
-	2WTC - Col. 905 Elev. Pit 55B Floor 43	Few inches exposed steel on column Light surface rust	9
-	2WTC - Col. 806 Elev. Pit 56B Floor 43	Moderate rust on inside of column flanges Partially exposed splice plates Missing fireproofing up to splice plate Bolt heads on splice moderate rust	9
54	2WTC - Col. 706 Col. 805 Elev. Shaft 61B Shaft 62B Floor 57	Connecting beams missing fireproofing Exposed steel due to guide rail angle attachments Typical throughout shaft	12 & 2

Photograph Listing of 2 WTC

Photo No.	Location	Existing Conditions	Item No
55	2WTC - Col. 706 Elev. Pit 61B Floor 43	Bracing added from column to beam at floor above, top portion, no fireproofing or sheet rock enclosure	15
56	2WTC - Col. 706 Elev. Pit 61B Floor 43	Bracing added from column to beam at floor above, column portion, no fireproofing Fireproofing missing at column	15
57	2WTC - Col. 805 Elev. Shaft 62B Floor 57	Exposed splice Light rust	1
58	2WTC - Col. 805 Elev. Pit 62B Floor 43	Moderate surface rust Bolts partially exposed Deterioration of fireproofing	9
-	2WTC - Col. 801 Elev. Shaft 63B Floor 43	Approx. 5" of missing fireproofing from base of column Debris and storage area	9
-	2WTC - Col. 701 Elev. Shaft 67B Floor 42	Flange exposed Light surface rust	9
-	2WTC - Col. 802 Elev. Shaft 68B Floor 43	Approx. 5" missing fireproofing from column flange	9
-	2WTC - Col. 802 Elev. Shaft 69B Floor 43	Exposed steel on column Light surface rust Column web exposed to floor below	10
59	2WTC - Col. 702 Elev. Shaft 70B Floor 67	Bolts beginning to expose on web of beam Flange partially exposed on edge and far end of column flange where sheet rock enclosure is damaged Deterioration of column fireproofing	1
60	2WTC - Col. 702 Elev. Shaft 70B Floor 69	Splice exposed Light surface rust	1
61	2WTC - Col. 702 Elev. Shaft 70B Floor 72	Splice exposed Light surface rust	1
-	2WTC - Col. 707 Elev. Pit 78B Floor 76	Exposed steel at base of column	9
-	2WTC - Col. 806 Elev. Pit 79B Floor 76	Exposed steel at base of column at flange and web Light surface rust	9
62	2WTC - Col. 801 Elev. Pit 82B Floor 77	Moderate rust at the underside of the flange of the partially embedded elevator beam	10
-	2WTC - Col. 802 Elev. Shaft 88B	Small patches of steel exposed less than one square inch of area on beams and columns Typical throughout shaft	12 & 1
63	2WTC - Col. 702 Elev. Shaft 89b Floor 82,91,96 & Up	Deterioration of fireproofing at bottom flange connection to column, varying degrees of deterioration of fireproofing	12

Photograph Listing Of 2 WTC

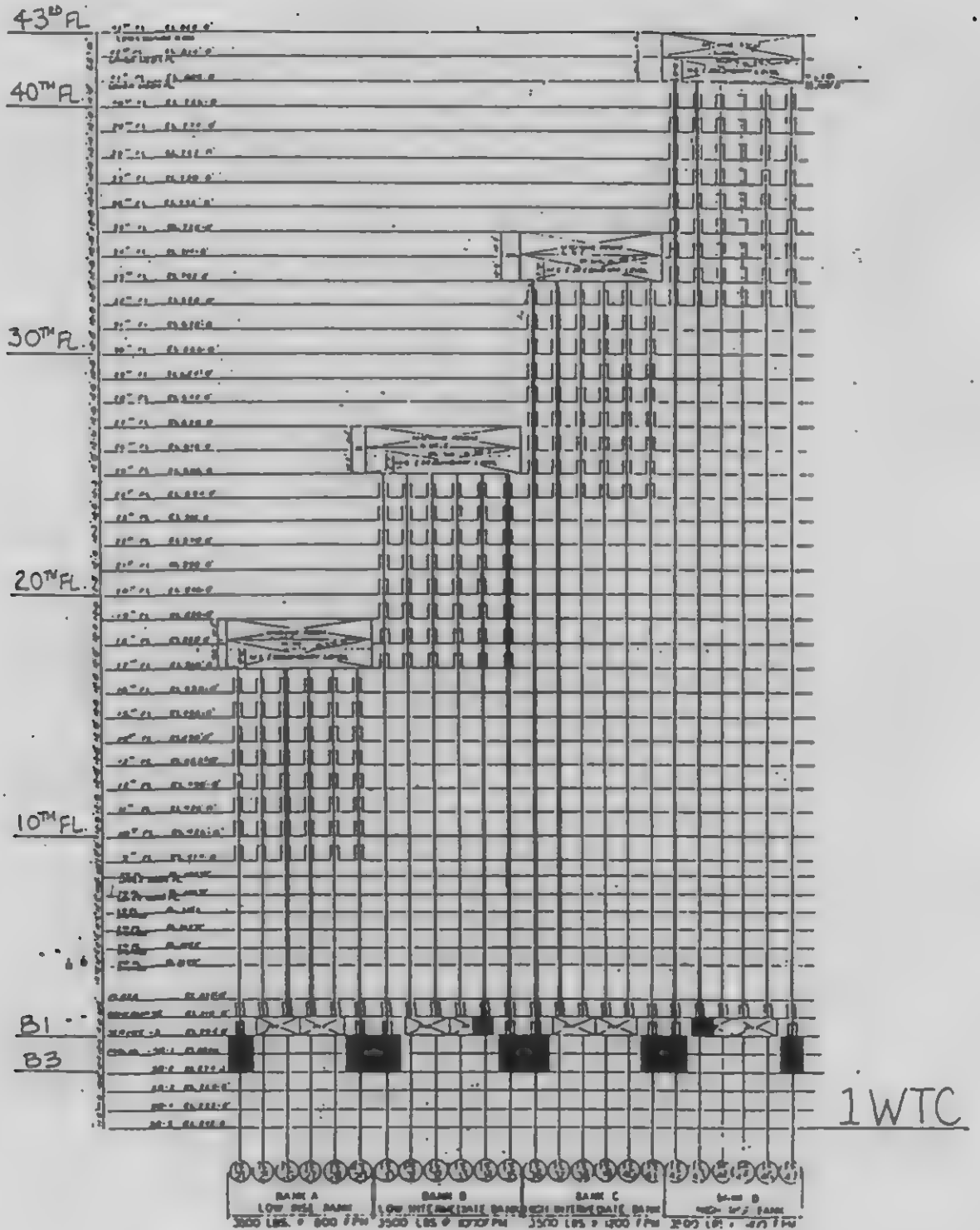
Photo No.	Location	Existing Conditions	Item No
64	2WTC - Col. 702 Elev. Shaft 89B Floor 82	At beam intersection at corner of shaft, deterioration of fireproofing Bolts and web of beams exposed Typical throughout shaft	12
65	2WTC - Col. 802 Elev. Shaft 89B Floor 93	Connecting beam exposed behind cable and chicken wire	12
66	2WTC - Col. 802 Elev. Shaft 89B	Deterioration of fireproofing of bolts at bottom flange of beam at column connection Typical throughout shaft	12
-	2WTC - Col. 702 Elev. Pit 89B Floor 77	Deterioration of fireproofing at edge of column flange Light surface rust	9
67	2WTC - Col. 706 Elev. Pit 95B Floor 77	Column flange and webs exposed steel Moderate surface rust	9
68	2WTC - Col. 706 Elev. Pit 95B Floor 77	Rough slab surface Typical throughout all pits	11
-	2WTC - Col. 706 Elev. Shaft 96B Floor 101	Web steel exposed at guide rail angle attachment Exposed flange approx. 4" high Light surface rust	2 & 1
-	2WTC - Col. 706 Elev. Shaft 96B Floor 77	Exposed steel at bottom flange of connecting beam Bolts on beam exposed	12
69	2WTC - Col. 706 Elev. Shaft 96B	Small diameter of fireproofing missing with paint marking, appears to be testing area Typical throughout all shafts	1
70	2WTC - Col. 806 Elev. Pit 96B Floor 77	Exposed web of column to floor below Deterioration of fireproofing Light surface rust	10

LERA

APPENDIX C

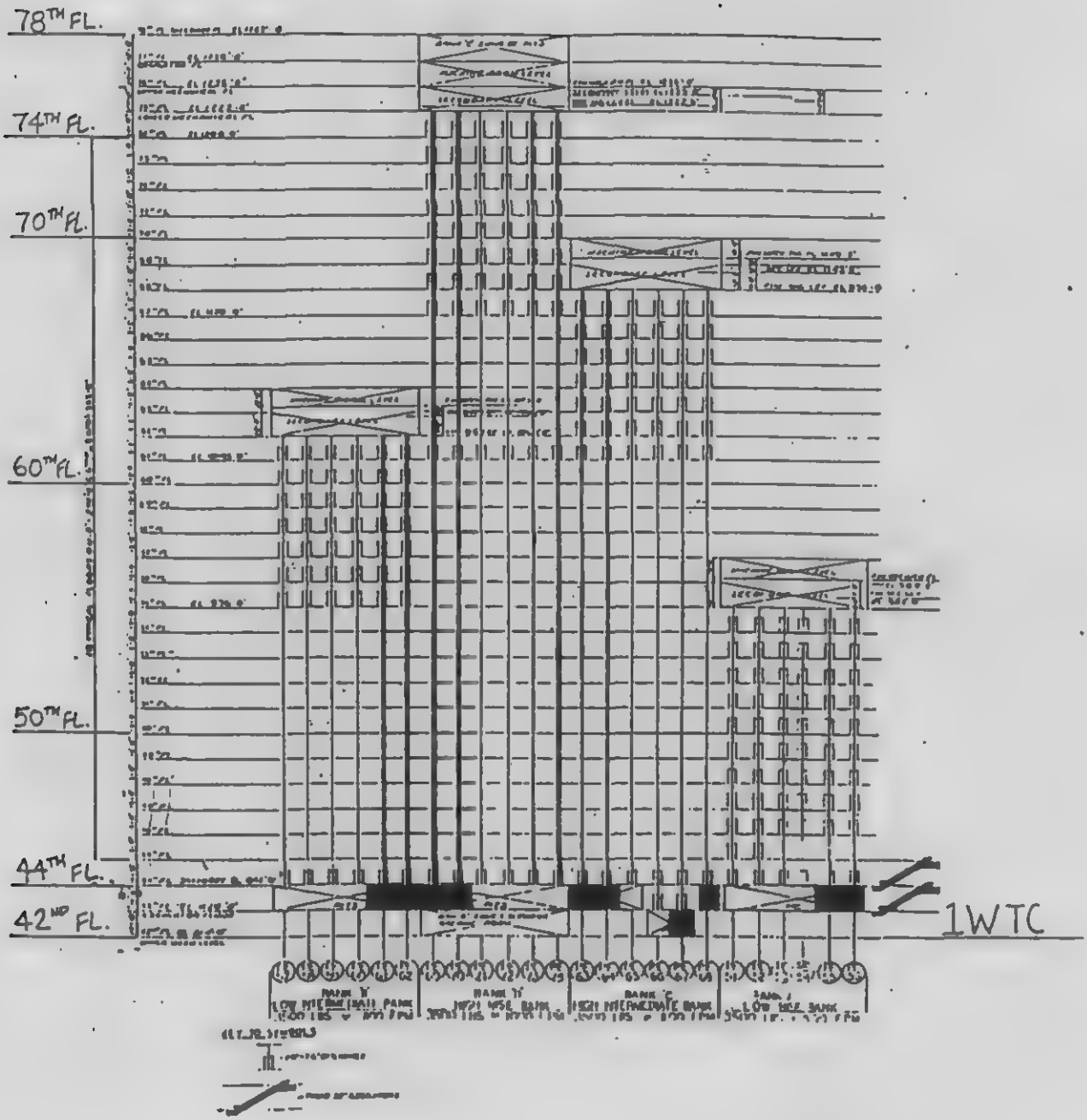
FIGURES OF TOWER ONE
SCHEMATIC SECTION OF ELEVATORS - 1 WTC

LERA



SCHEMATIC SECTION
ZONE I- LOCAL ELEVATORS

LERA



SCHEMATIC SECTION
ZONE II - LOCAL ELEVATORS

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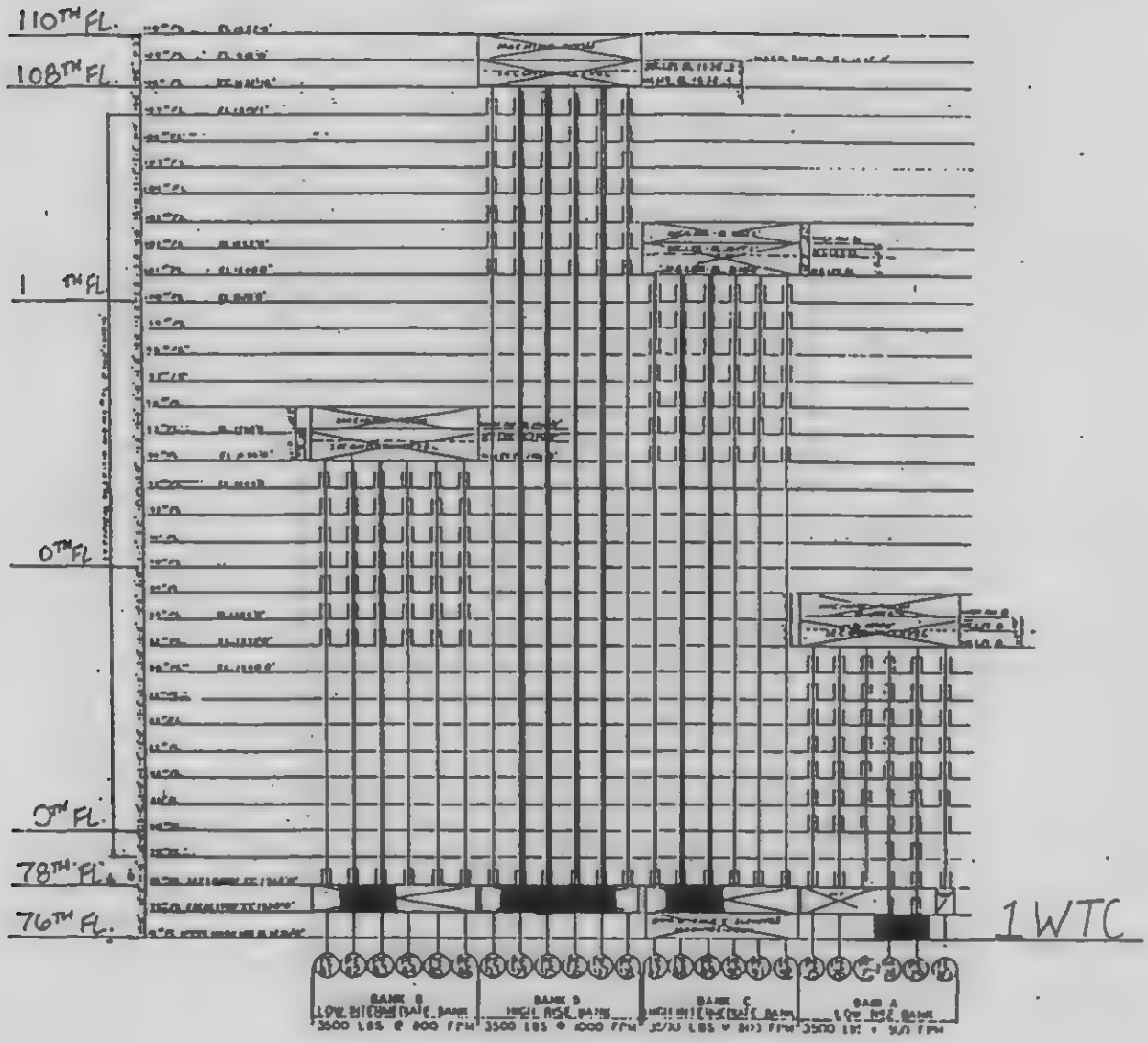

SCHEMATIC SECTION
ZONE III - LOCAL ELEVATORS

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APPENDIX D

FIGURES OF TOWER TWO
SCHEMATIC SECTION OF ELEVATORS - 2 WTC

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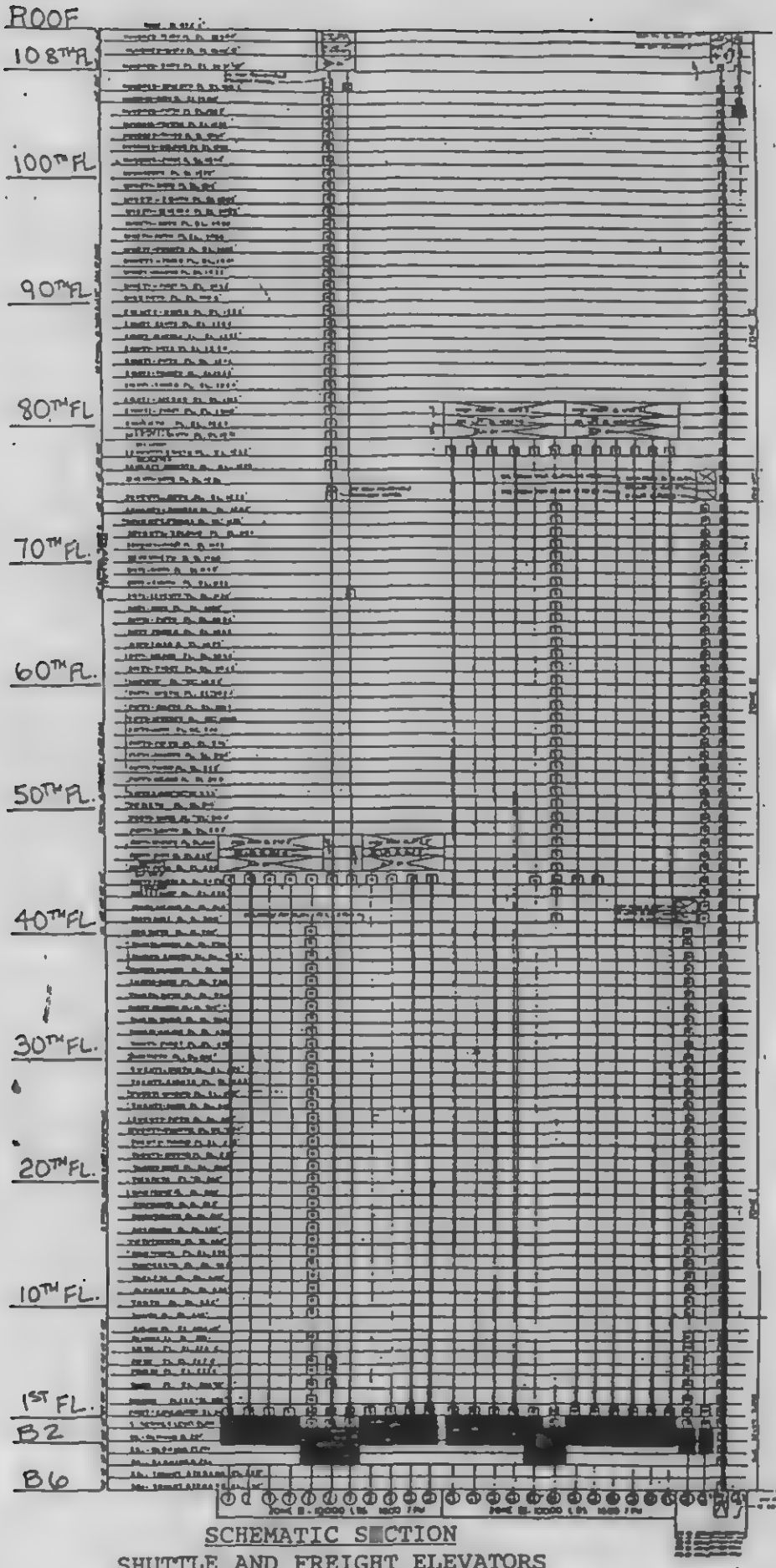
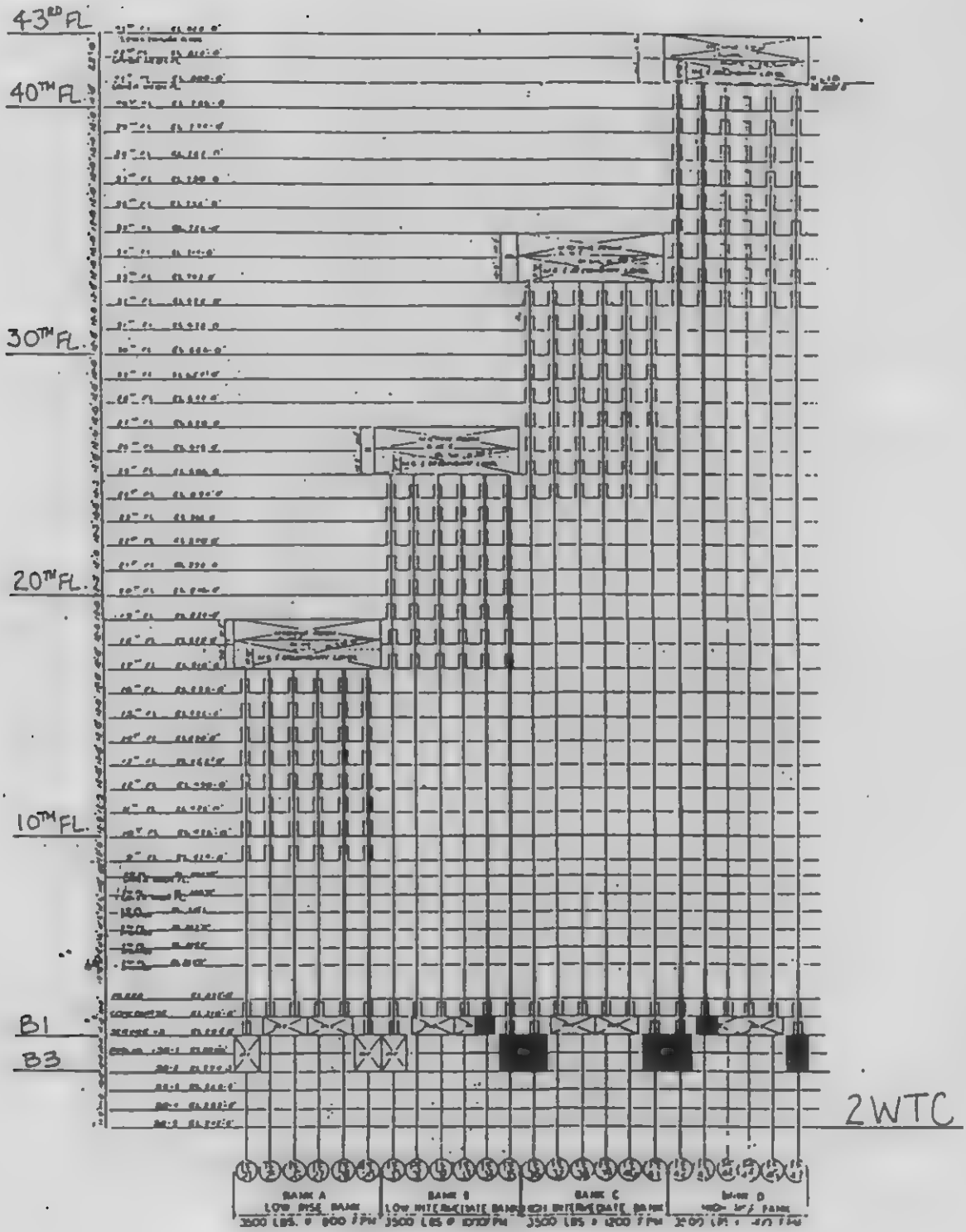


SCHEMATIC SECTION
SHUTTLE AND FREIGHT ELEVATORS

LERA



SCHEMATIC SECTION
ZONE I- LOCAL ELEVATORS

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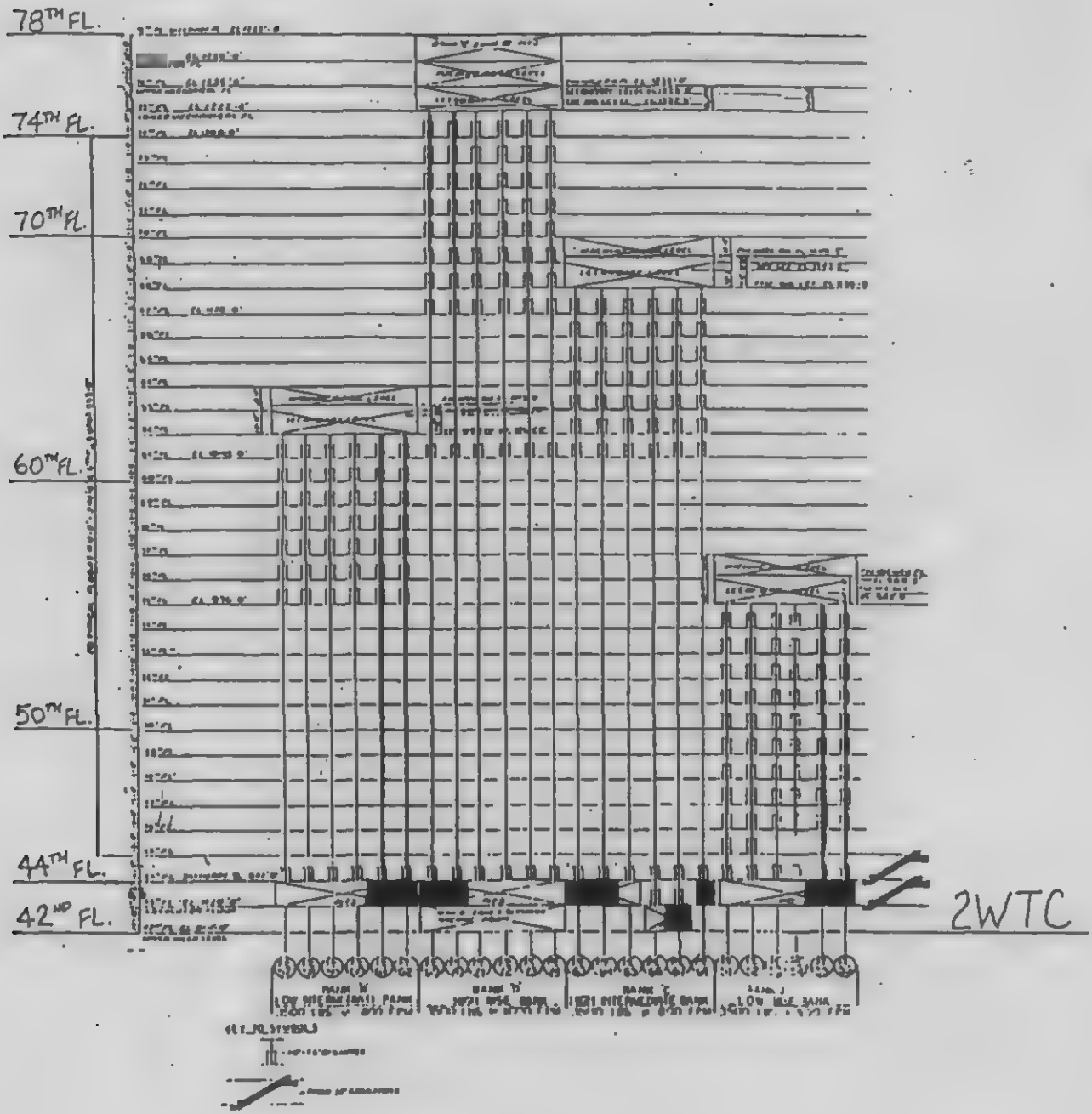
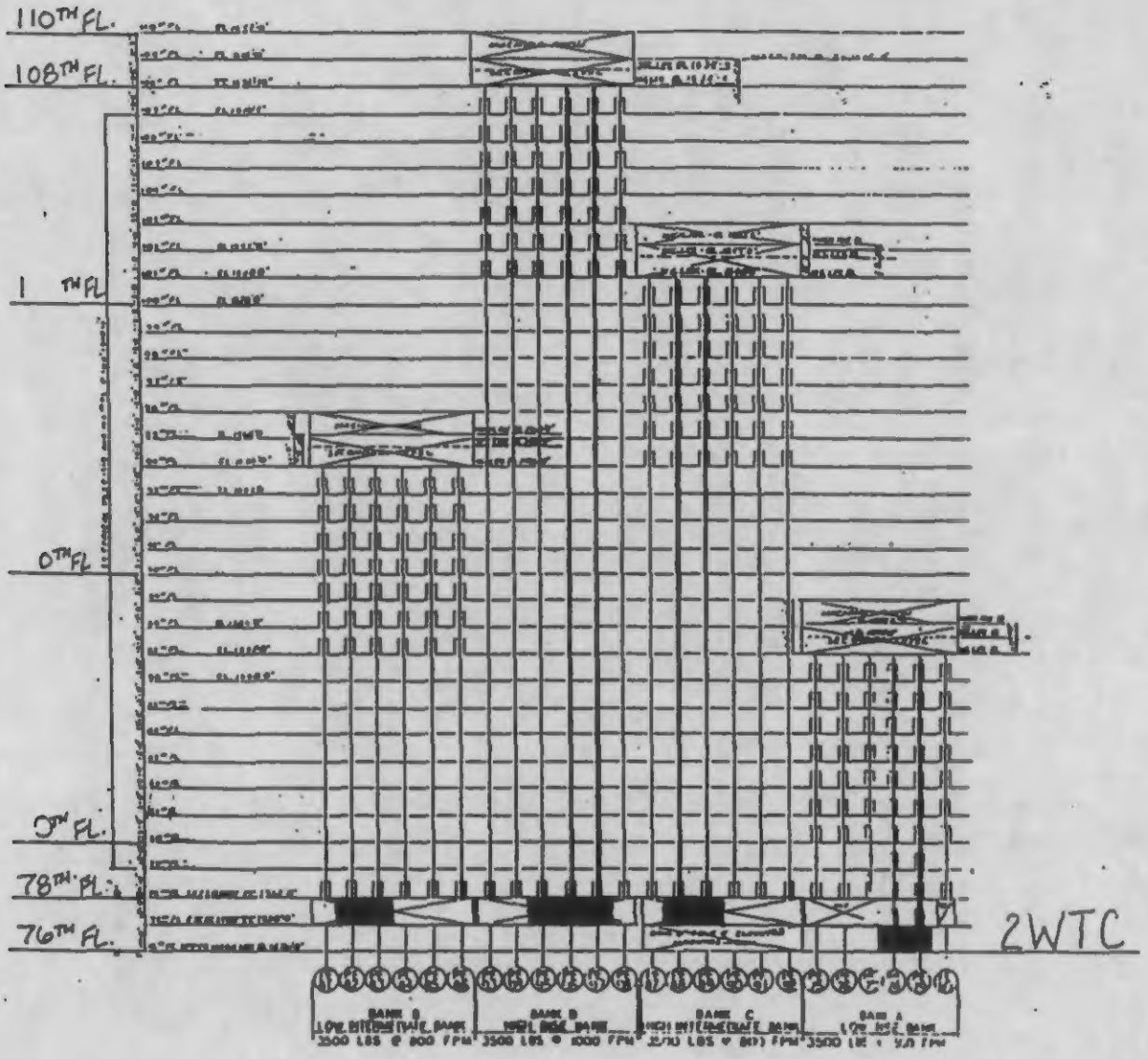


SCHEMATIC SECTION
ZONE II - LOCAL ELEVATORS

LERA



SCHEMATIC SECTION
ZONE III - LOCAL ELEVATORS

LERA

APPENDIX E

REPAIR PROCEDURES

LERA

FIRE PROTECTION REPAIR PROCEDURE

SPRAYED AND TROWELED FIRE PROTECTION

1. WHERE PRACTICAL, IDENTIFY BRAND AND TYPE OF FIREPROOFING INITIALLY USED (LARGELY CAFCO BLAZE SHIELD AND GRACE MONOKOTE IN 1 AND 2 WTC).

2. AS RECOMMENDED BY U.L., REPAIR "IN KIND".

WHERE ISOLATEK FIREPROOFING PRODUCTS ARE IDENTIFIED:

- IF AREA IS LESS THAN THREE SQUARE FEET, PREPARE SURFACES AND TROWEL ON CAFCO FIBER PATCH (BY ISOLATEK) OR EQUIVALENT PER MANUFACTURER'S SPECIFICATIONS.
- IF AREA IS GREATER THAN THREE SQUARE FEET, PREPARE SURFACES AND SPRAY ON NEW BLAZE SHIELD (BY ISOLATEK) OR EQUIVALENT PER MANUFACTURER'S SPECIFICATIONS.

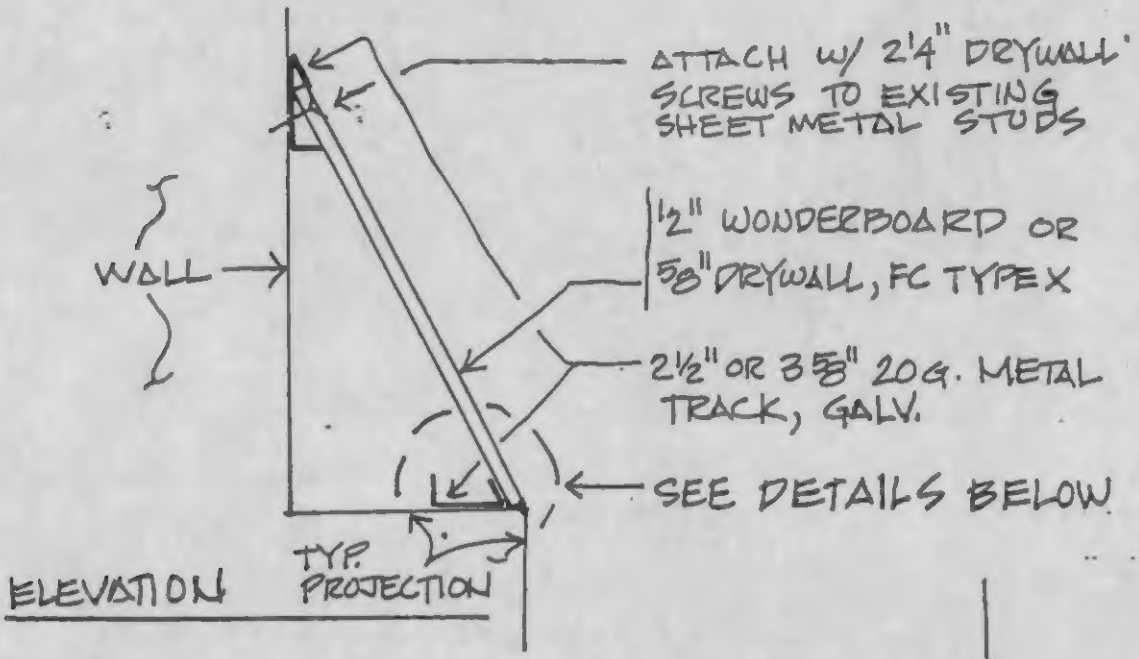
WHERE GRACE FIREPROOFING PRODUCTS ARE IDENTIFIED:

- IF AREA IS LESS THAN ONE SQUARE FOOT, PREPARE SURFACES AND TROWEL PATCH FIREPROOFING WITH MONOKOTE Z106 OR MONOKOTE Z146 (BY GRACE) OR EQUIVALENT PER MANUFACTURER'S SPECIFICATIONS.
- IF AREA IS LARGER THAN ONE SQUARE FOOT, PREPARE SURFACES AND SPRAY APPLY FIREPROOFING WITH MONOKOTE Z106 OR MONOKOTE Z146 (BY GRACE) OR EQUIVALENT PER MANUFACTURER'S SPECIFICATIONS.

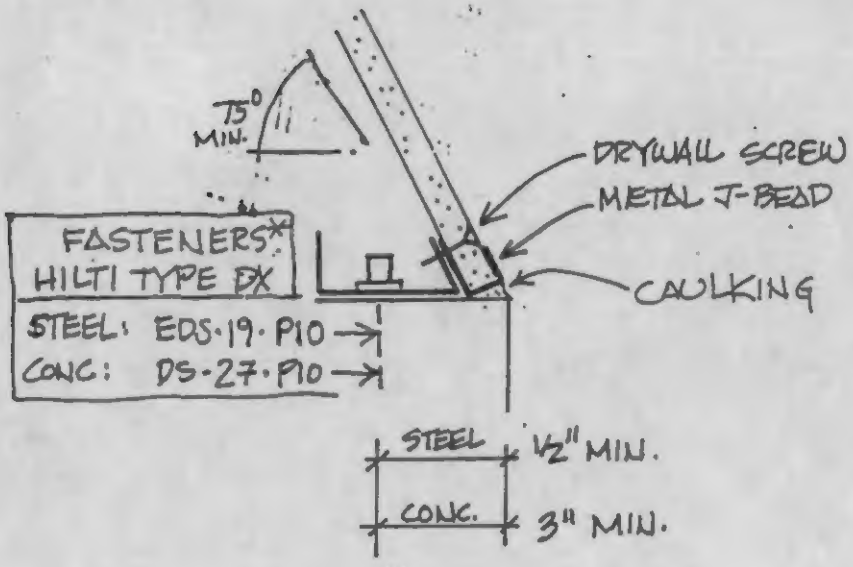
3. KEY NEW MATERIAL INTO THE MATERIAL SURROUNDING THE PATCH IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS. THE INTEGRITY OF THE SURROUNDING MATERIAL IS NOT TO BE IMPAIRED.

4. THE THICKNESS OF REPAIR MATERIAL IS TO GIVE THE SAME FIRE RATING AS MATERIAL INITIALLY USED.

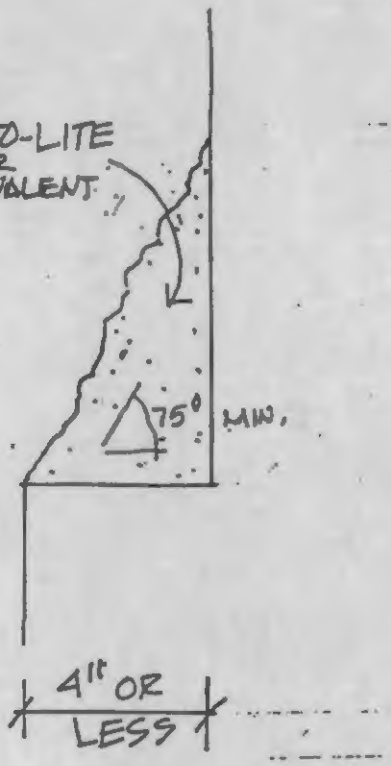
REV.	LERA LESLIE E. ROBERTSON ASSOCIATES CONSULTING STRUCTURAL ENGINEERS	P M	DRAWING NO.
	W.T.C - STRUCTURAL INTEGRITY INSPECTION	DRAFT	SK-1
	ELEVATOR PROJECTION CODE COMPLIANCE	DESIGN FAD	
		CHECK	10·18·94



ELEVATION



PROJECTIONS OVER 4"



PROJECTIONS UNDER 4"

* FASTENER SPACING 16" O.C. MIN. OF 2 PER CHANNEL